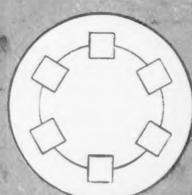
MARCH 1928—THIRTY-FOURTH YEAR

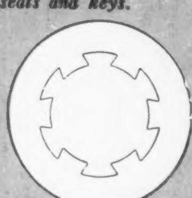
MACHINERY

THE INDUSTRIAL PRESS Publishers, 140-148 LAFAYETTE ST., NEW YORK

Bristo set screws won't shake loose



Think of the holding power of a socket designed with six key seats and keys.



The Bristo design is similar but goes a step farther. Dovetails in the wrench and screw interlock.

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A good grip on the screw is needed to set it tightly. Compare the diagram at the left and you will see the gripping action of the interlocking Bristo dovetails is even greater than the holding power of six keys.

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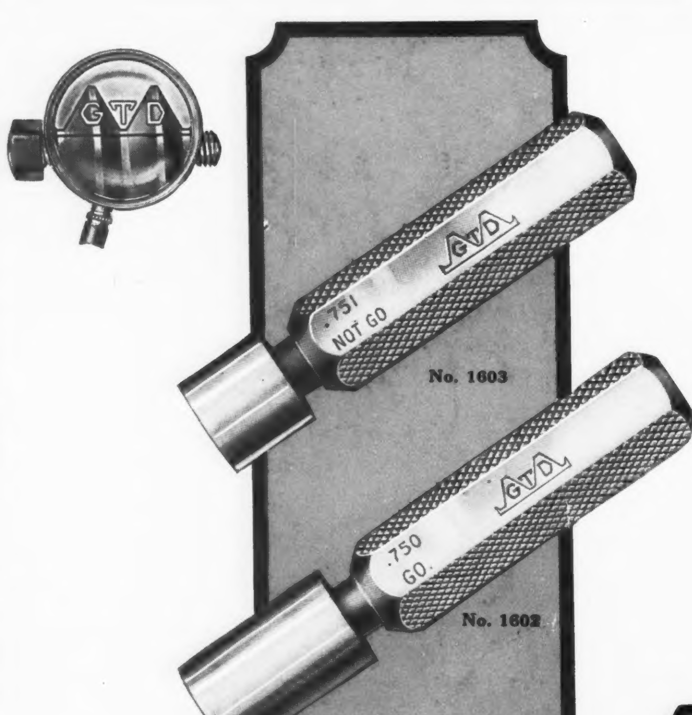

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L. M. McPharlin, Supervisor of Gaging at the Studebaker Corp., in "American Machinist," May 12, 1927.

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MACHINERY

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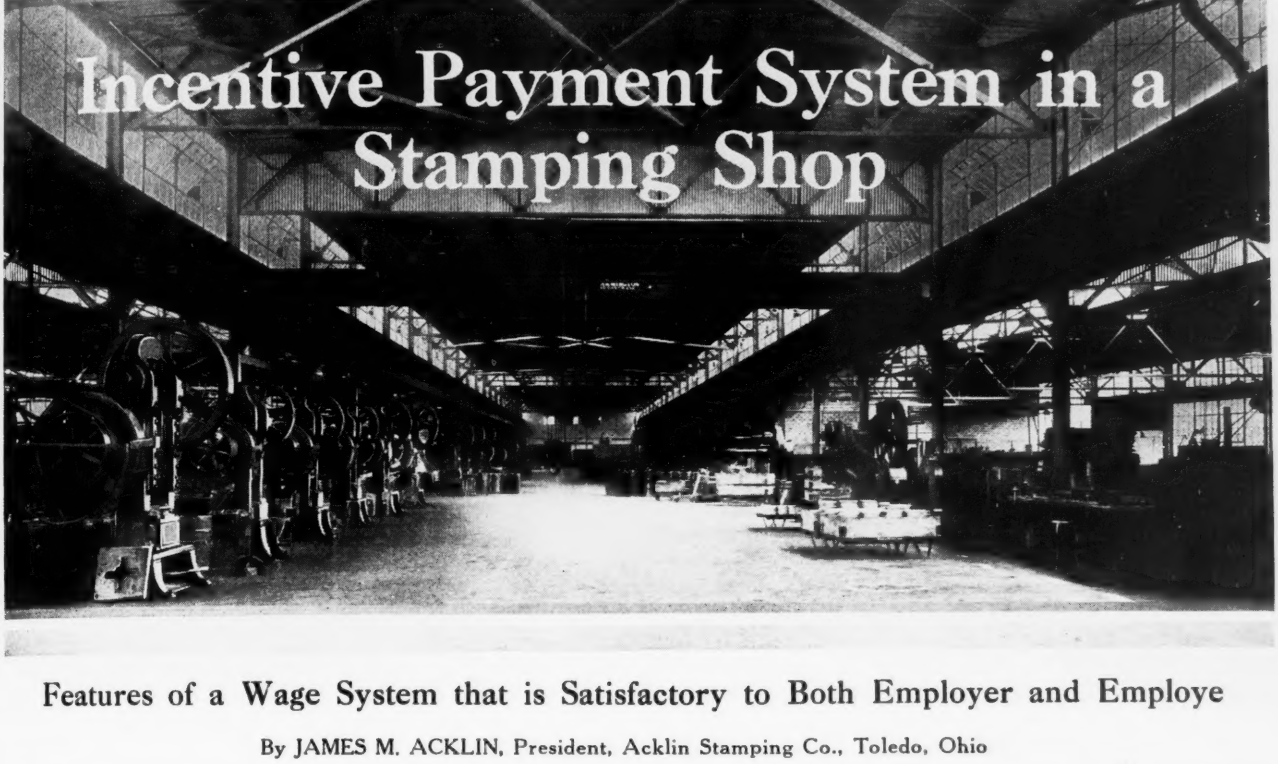


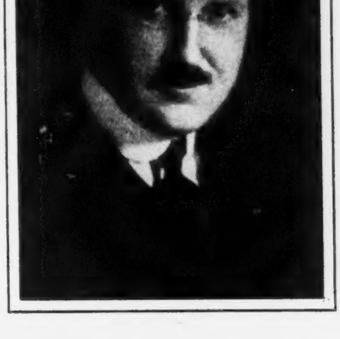
Incentive Payment System in a Stamping Shop

Features of a Wage System that is Satisfactory to Both Employer and Employe

By JAMES M. ACKLIN, President, Acklin Stamping Co., Toledo, Ohio

EMPLOYES must feel that they are being paid on a fair basis if work of good quality is to be turned out at costs that permit reasonable profits. For this reason, any wage system, to function efficiently, must be equally just to employer and employes. When employes are given the opportunity of substantially increasing their earnings without undue exertion, production speeds usually jump and costs are correspondingly lower.

All shop employes of the Acklin Stamping Co., Toledo, Ohio, with the exception of foremen and toolmakers, are paid a day wage and a bonus in addition. This bonus is based on actual production records. Men engaged in such occupations as trucking, inspecting, and shipping can conveniently be paid bonuses, since their work is considered as direct labor chargeable to the individual job and not to overhead. It has been found that the costs of these items can be far more easily controlled through this practice than when they are charged to overhead.



The basis on which incentive payments are made is fundamentally the same as for bonus systems in general, but has several novel features. For each operation in the shop, a standard rate of production per hour is set. This rate is intended to be the best possible production that a first-class man can maintain constantly under good conditions, a certain allowance being made for fatigue. As soon as an operator attains 60 per cent of the standard rate of production specified for the job, his bonus commences. Hence, if the standard production for an operation is 1000 parts per hour, as given on the ticket shown in Fig. 1, the operator receives a bonus when he reaches an hourly production of 600 parts. The benefits of the increased production are divided equally between the company and the employe; in other words, the bonus paid to the employe corresponds to one-half the time saved, multiplied by his hourly wage rate. Thus an employe earns 33 1/3 per cent more than his regular day wage when he reaches the standard production rate and is considered 100 per cent efficient. As a good man is able to maintain this production, there are opportunities for substantial earnings.

Standard rates of production for each machine operation are specified either from time studies of the

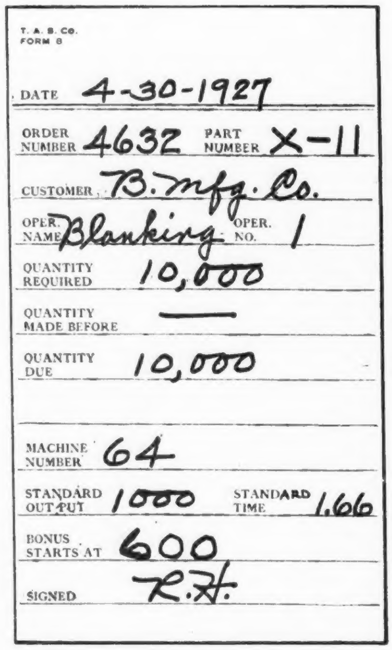
JAMES M. ACKLIN, president of the Acklin Stamping Co., Toledo, Ohio, was born in Toledo in 1884. After graduating from high school in 1902, he went to Cornell University, graduating in 1906 in mechanical engineering. He then entered the employ of the Toledo Machine & Tool Co., manufacturer of power presses, shears, and other sheet-metal working machinery, starting as a day laborer and passing through the various departments in the machine shop, die shop, pattern shop, drafting-room, and purchasing office. In 1911 the Acklin Stamping Co. was organized by Mr. Acklin's father, brother, and himself, with a few other associates, for the purpose of manufacturing sheet-metal articles on a quantity basis for other manufacturers. The company now occupies a building specially erected for its needs, with a floor area of 90,000 square feet. Mr. Acklin is a member of the Society of Automotive Engineers.

actual operation or from charts such as illustrated in Fig. 2. Charts have been developed for all kinds of dies used in the shop, and for rate-setting, the dies are divided into three classifications—raised dies, nested dies, and cutting and blanking dies. The charts were constructed after extensive time studies had been made on all sorts of steps involved in the operation of power presses. They can be used both for setting standard rates of production and for checking time studies made on new operations.

Some of the charts are based on the perimeter, depth, and gage of the work, and others merely on the size of the piece. The particular chart illustrated is based on the greatest dimension of the work and gives the handling time for work on presses equipped with nested dies. This chart is used in conjunction with a list that gives the number of strokes made per minute by each press in the shop and the actual time per stroke. By adding the handling time to the time per stroke of the machine on which the job is to be performed, the standard rate of production can readily be figured. The fatigue allowance is determined from charts made up after a careful study of the effect of various operations on the physical condition of the operators.

Each job is carefully analyzed in making a time study. For instance, in a given operation, it may be necessary to determine the time required (1) to pick up a strip of metal and place it in the die; (2) to blank a certain number of pieces; (3) to turn the stock end for end in the die; (4) to blank the remaining number of pieces; and (5) to lay the scrap aside.

After the standard rate of production has been determined, a ticket, such as shown in Fig. 1, is made out and attached to the machine on which the work is to be done, so that the operator will know all the particulars about the job. It will be seen that the tag illustrated was issued for an order requiring 10,000 parts and that a standard production rate of 1000 pieces per hour was specified. The bonus started with a production of 600 parts per hour or whenever the production in 1.66 hours became better than 1000 pieces.


T. A. B. Co.
FORM 0

DATE	4-30-1927
ORDER NUMBER	4632
PART NUMBER	X-11
CUSTOMER	B. Mfg. Co.
OPER. NAME	Blanking
OPER. NO.	1
QUANTITY REQUIRED	10,000
QUANTITY MADE BEFORE	—
QUANTITY DUE	10,000
MACHINE NUMBER	64
STANDARD OUTPUT	1000
STANDARD TIME	1.66
BONUS STARTS AT	600
SIGNED	R. H.

Fig. 1. Typical Tag Made out for Each Press in the Shop

The day rate of the employe goes on constantly, and so a man is not penalized when the machine is stopped through no fault of his. If a man earns a bonus between the hours of 8 and 10, for instance, he does not lose the additional pay if the machine should be stopped for repairs later in the day. Thus the system is arranged so that the employes do not lose through faults of the management.

How the Pay is Calculated

Time cards of the type shown in Fig. 3 are used. Each employe "rings up" on one of these cards at the beginning of the day and whenever he starts work on a new order. The card illustrated shows that on April 30, 1927, employe No. 194 started at 7:00 A.M. to work on order No. 4632. The counting device on the machine registered 943 at this time. When the operator stopped working on the job at 12:00 o'clock noon, the counter registered 6786, showing that 5843 pieces had been produced in 5 hours.

With an allowed time of 1.66 hours per thousand, the total allowed time for this production was 5.843 × 1.66 or 9.7 hours, as shown on the card. Subtracting the actual time of 5 hours from the total allowed time of 9.7, and dividing the result by 2, gives 2.3 hours as the time for which the

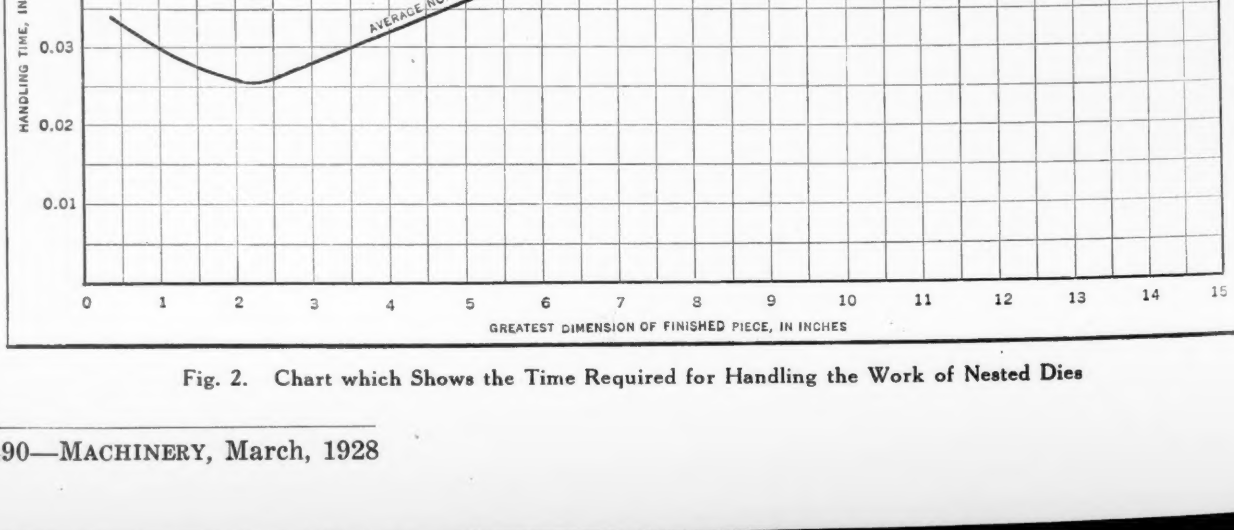


Fig. 2. Chart which Shows the Time Required for Handling the Work of Nested Dies

operator was paid a bonus. Thus for the period of time covered by the card, the operator received compensation for 7.3 hours, instead of for only 5.

Electric Machines Facilitate Accounting

When the time cards reach the cost department and the various spaces have been completely filled in, holes are punched through the cards, as shown in Fig. 3, according to the information carried on them.

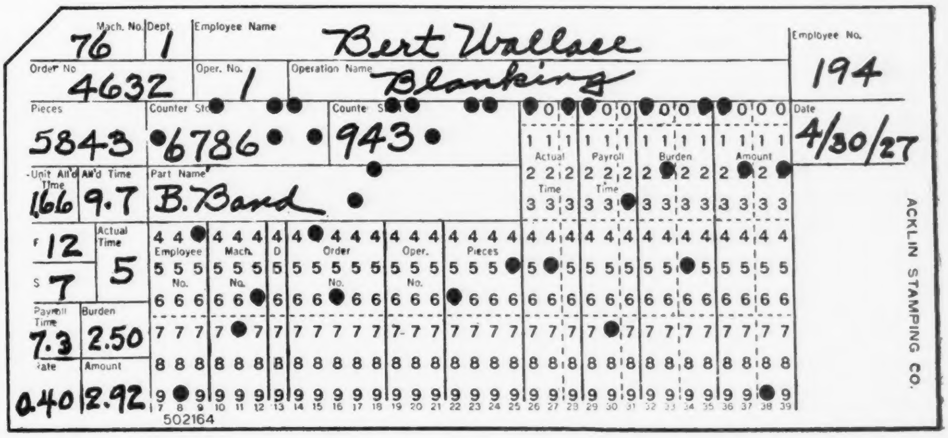


Fig. 3. Time Card Punched for Use in Electric Sorting and Tabulating Machines

Holes are punched through two cards simultaneously, the second card being of the same size as the card shown, but instead of having spaces for writing in the information, it has thirteen columns in which rows of figures run vertically from 0 to 9 in the same manner as the four columns seen near the right-hand end of the card in Fig. 3. The second card is retained in the cost department, while the original card goes to the pay roll department.

The punching of the two cards is done in a small electrically operated machine, such as is seen in Fig. 4 being operated by the girl at the left. This machine has only fourteen keys, the card moving automatically from left to right beneath the punches as required. Holes are punched to indicate the date on the card, employe's number, machine number, employe's department number, order number, operation number, number of pieces, actual time, pay roll time, burden, and amount paid.

From Fig. 3 it will be seen that the four right-hand columns indicate an actual time of 5 hours, a pay roll time of 7.3 hours, a burden of $2.50 and an amount paid the operator of $2.92.

The electric machine seen in the center of the illustration Fig. 4 can be used for sorting groups of cards in any combination of the thirteen rows of punched columns. As an example, it may be desired to select from several hundred cards all the cards of men working on a given date, the cards of one man over a certain period of time, or the cards for one order number, etc. Any sorting of this nature can be accomplished in a few minutes by simply setting the machine so that the desired cards will all fall into a particular pocket and then running the cards through the machine.

After a group of cards has been sorted as described, they can be run through the tabulating machine shown at the right, which automatically adds up the amounts punched in any one column of all the cards placed in the machine. For instance, all cards of a given order number can be run through this machine to determine the total cost of the job, or the cards of one workman can be run through to determine his pay for a certain period of time.

These sorting and tabulating machines are rented from the International Business Machines Corporation and are covered by the Hollerith patents. Similar machines are used in the Census Bureau of the United States Government.

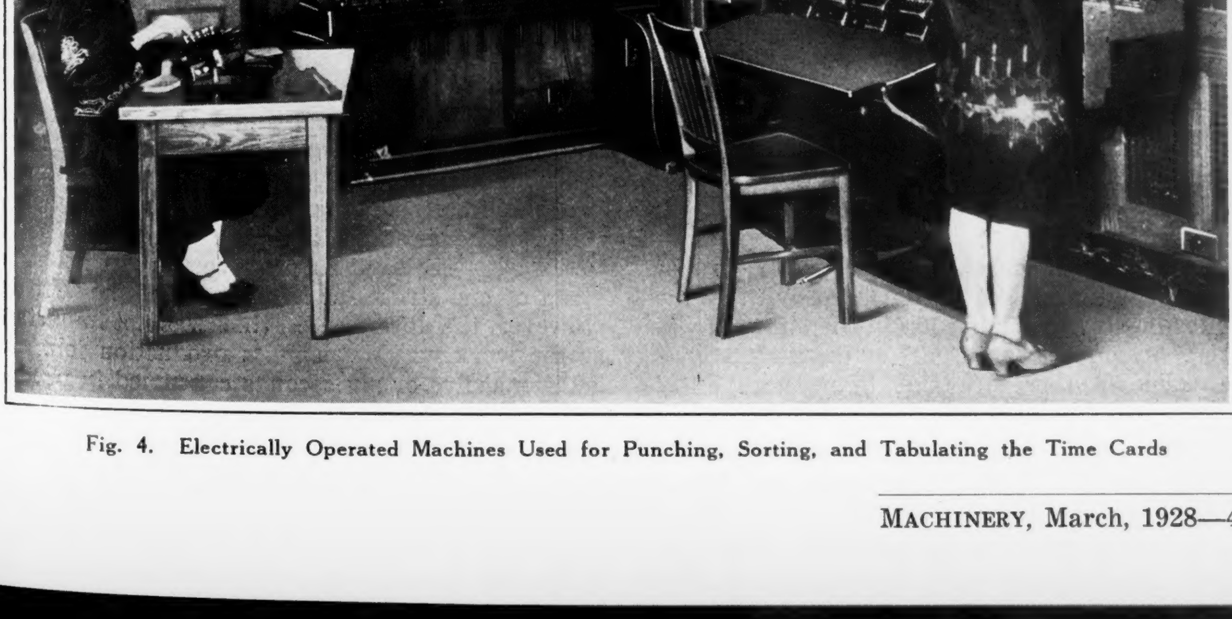


Fig. 4. Electrically Operated Machines Used for Punching, Sorting, and Tabulating the Time Cards

Precision Indexing Die

By HENRY SIMON

THE production of the blade shown at *A*, Fig. 1, presented some unusual difficulties. The material is 0.050 inch thick, and is very hard, being cold-rolled and polished crucible steel strip stock having a carbon content of 0.8 to 0.9. The ten small holes are required to be held within relatively close limits of accuracy, as indicated by the maximum and minimum dimensions.

At first a punch and die was used which pierced the ten holes at a single stroke of the press. As the blanks were previously cut to shape, the piercing operation completed the work. The tools consisted of a disk-shaped die member, mounted in an ordinary shoe, and a punch member similar in general arrangement to that shown at *B*, in which the ten individual punches were positively guided by a sliding spring-actuated stripper which was accurately aligned with the die.

To make such a die and get it right was not easy, because of the large number of closely spaced holes and the close limits on the product. The deformation of the work caused by the release of internal stresses or tension in the material when pierced absorbed a large part of the limits. Every precaution was therefore taken in making the tools.

The die and stripper were made practically alike in diameter and thickness, so as to obtain uniform shrinkage. "Proportion" holes of approximately the size and mean radius of the perforations were spaced around the blank portions of the piercing holes to counteract warpage. Both pieces were made from the best non-shrinking tool steel and carefully heat-treated. However, it was only after two unsuccessful attempts that a set was produced in which the errors were small enough to render it practicable to correct them after hardening.

This die was put in use, and though it wore down rapidly, it performed creditably until it was decided to use a slightly harder stock. It then became clear beyond question that a die of this type would not furnish a lasting solution of the problem.

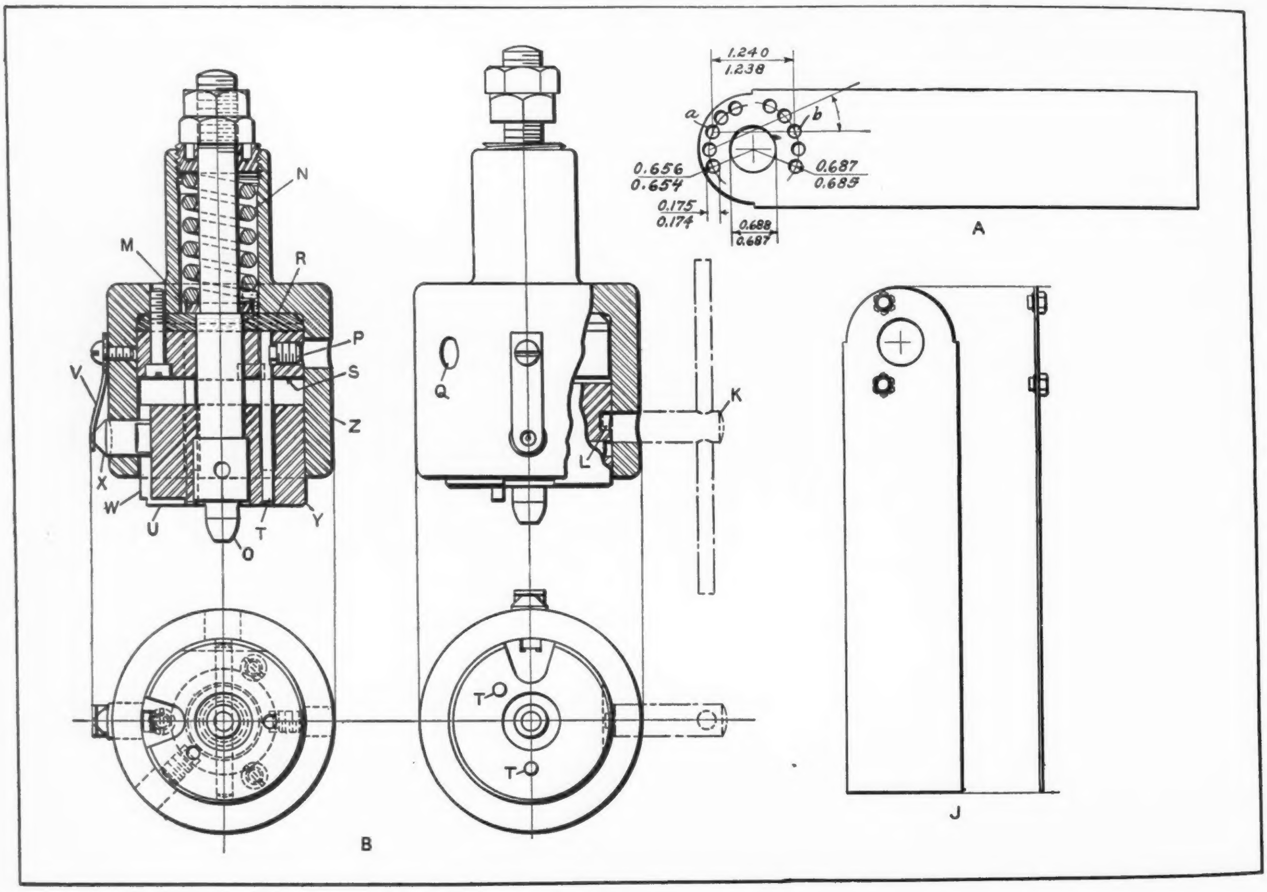


Fig. 1. Punch Member of Indexing Die for Piercing Holes in Part A

The writer then designed the punch and indexing die shown in Figs. 1 and 2, respectively. Although this die appears to be more complicated, it did not cost a great deal more to produce than the one just described. The new die proved very satisfactory in every way, although five strokes of the press were required to produce the ten holes, instead of one stroke, as in the case of the first die. However, the difference in time was not important, as the work was not a mass production job. An additional five or six seconds consumed in production did not, therefore, make any vital difference. On the other hand, the increased accuracy of the

work produced by the new die, the long life of the die, and the freedom from expensive repairs more than make up for the small loss of time.

Limits on the drawing of the product show that the location of the holes is not primarily a matter of the radial distance and the angle between individual successive holes, but rather of the distance between pairs of holes, such as *a* and *b*, Fig. 1, and the angle between each pair of holes, which had to be held to limits of plus or minus two minutes. The indexing die insures maintaining these basic requirements by producing a single pair of holes at each stroke of the press, the blade being pivoted on the large central hole while mounted on a swinging arm which is indexed to five punching stations or positions. The distance between holes *a* and *b* therefore remains practically constant. As the radial distance of the stations is approximately twenty-five times the radial distance of the pierced holes, it is obvious that the angular error is exceedingly small.

In place of the regular die-shoe, the fan-shaped base *B*, Fig. 2, is used. A pivot pin *C* is mounted in the rear end of base *B*, in the center of the low hub flanked by the two bosses *D*. Hardened steel bushings *E* are located 22 1/2 degrees apart in the machined face of the quadrant, and are engaged by a pin in the front end of the swinging blade-carrier *F*. The upper face of the hub of the blade-carrier is made 0.001 inch lower than the bosses *D* in order to permit the carrier to swing freely when the die plate *G* is clamped in place.

The enlarged holes through which the clamp-screws *I* pass permit plate *G* to rock on pin *C* a limited amount. This provides for making an initial adjustment of plate *G* relative to the blade-carrier, the final adjustment being permanently fixed by means of relocating pins *H*. Two bushings *J* are seated in this plate, which, in addition, carries a spring clip *K*, held in place by a single screw and located by a pin. This clip serves to prevent the blade from springing up under the suction caused by the stripper on the return stroke. A low channel-like recess *L* in the bottom of the plate receives the punchings, which are ejected by a blast of compressed air entering through pipe *M*.

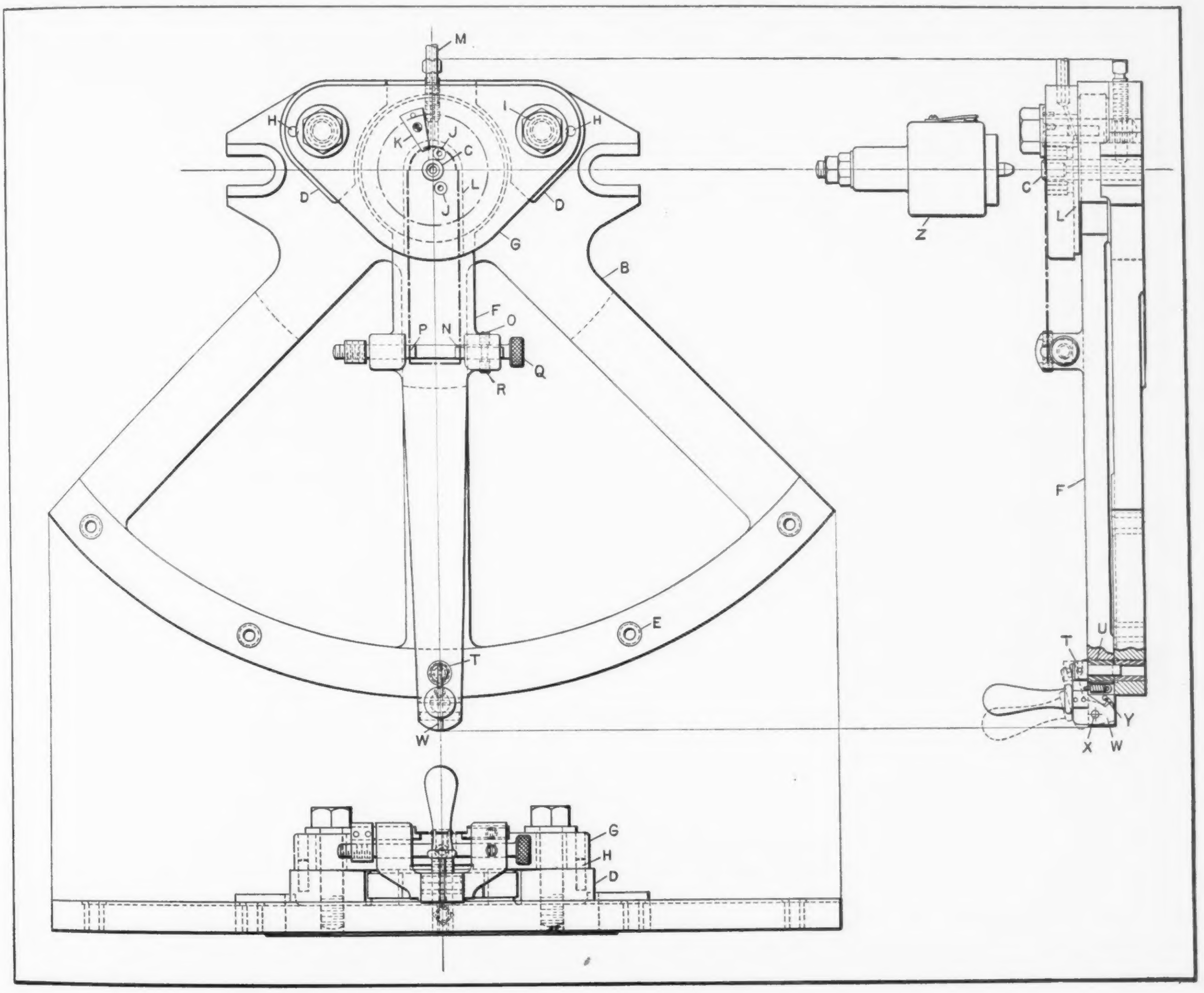


Fig. 2. Die Member Used with Punch Shown in Fig. 1

The clamping mechanism on the work- or blade-carrier *F* consists of an adjustable registering pin *N*, which is held in place by a set-screw *O*, and the clamping pin *P*, which is given a quick opening and closing movement by the blade-clamping screw *Q*. Screw *Q* is retained in its proper longitudinal position by a screw *R*, the end of which projects into an annular recess in the screw stem. The front ends of pins *N* and *P* are notched out to half their depth. This leaves a short flat tip below the registering faces of each pin, which serves as a rest for the end of the blade to be pierced.

The indexing or positioning of the blade-carrier is accomplished by a pin *T*, which works in a bush-

ing U located in the carrier in line with the quadrant bushings E. The slotted head of pin T straddles the raising blade W, and by means of a cross-pin, engages a slot in the end of the raising blade, which is riveted to the lever handle and pivoted at X. A stop-pin Y limits the opening movement of the handle, which is automatically returned by means of a coil spring located in a hole formed in the raising blade slot.

The upper or punch member has a heavy tool-steel shell Z in which the punch guide or stripper disk Y, Fig. 1, is a close sliding fit. Disk Y is prevented from rotating by the slabbed end of pin X, which enters a longitudinal slot W. Pin X is held in position by a flat spring V. A small recess U formed in the bottom of the punch guide provides room for the blade-holding clip K, Fig. 2, on the die plate.

Two punches T, Fig. 1, are locked in place in block S, with their upper ends in contact with a thrust plate R. Block S and plate R are secured to the shell by three machine screws. Holes Q through the outer shell make it possible to turn the screws P for removing the punches T or clamping them tight.

A central stud O, firmly seated and cross-pinned in the punch guide, aligns the upper and lower tools, the projecting end fitting into a corresponding recess in the die pivot pin C, Fig. 2. This pin also serves to maintain the alignment of the punch guide by means of its bearing in the thrust plate R, Fig. 1. Another function of pin O is to transmit pressure from the heavy coil spring N to the punch guide.

A narrow slot or groove L in the punch guide Y is provided to facilitate the removal of the punches. This annular groove is located beside a hole in the shell Z in which an eccentric-end key K can be inserted. By turning this key, the punch guide can be raised and held in the position shown in the upper right-hand view of the punch member. The punch can then be seized with pliers and removed or a new punch inserted. Key K is also used for raising guide Y to facilitate aligning the upper and lower members when setting up the die.

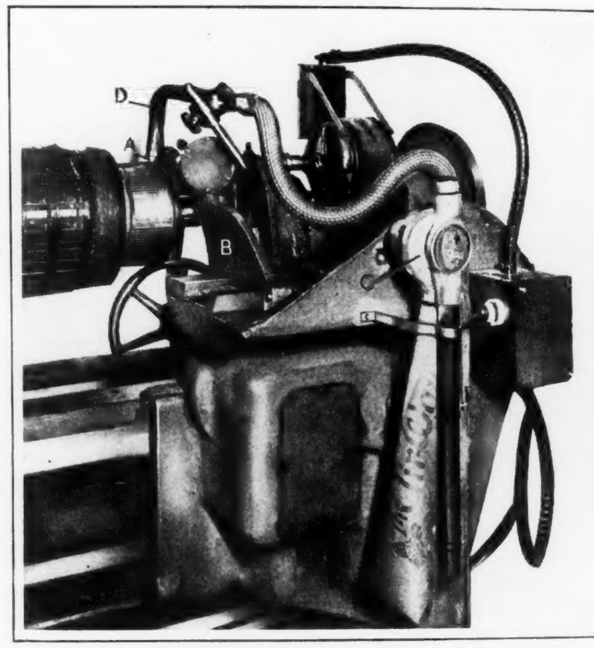
With the arrangement shown, the expense of sharpening and replacing the cutting members was reduced to a minimum. When first assembled, the piercing bushings rise slightly above the surface of the die plate, and can be ground two or three times without being removed from the guide. After the bushings have been ground down, they are raised by placing shims under them. Although the die is not of the sub-press type, no trouble was experienced through misalignment. As the upper and lower tools can be brought into engagement as described, it is an easy matter to obtain an accurate initial alignment which ordinarily need not be disturbed until the die is removed from the press. With the gibs or the press fairly tight, there is no reason why the guiding action of the center stud should not be sufficient to maintain alignment of the tools during the working stroke.

In order to provide a ready means of reference for checking the relative position of the hole pattern to the center line of the blade, and therefore, of the relative positions of the die plate and the registering pin, the gage shown at J was used. It consists of a regular blade with a single pair of holes punched out in the ideal location, hardened studs which closely fit the die bushings being seated in these holes. When this gage is placed on the die with the studs engaged in the piercing bushings, a proper alignment of the parts is clearly indicated by the fact that the edge of the blade will be in contact with the face of the registering pin.

* * *

NOVEL USE OF A VACUUM CLEANER

After the copper and mica sheets of commutators used in electrical apparatus have been assembled and turning and boring cuts have been taken, it is the practice of the Renewal Parts Plant of the Westinghouse Electric & Mfg. Co., located at Homewood Station, Pittsburg, Pa., to mill each mica sheet along the outside of the commutator to



Drawing away the Dust Produced in an Operation by the Use of a Vacuum Cleaner

a depth of about 1/32 inch in relation to the copper sheets. On the smaller sizes of commutators, this operation is performed in a special machine by means of a cutter 5/8 inch in diameter, as shown at A in the illustration. This cutter is traversed back and forth over the work as head B is reciprocated on its slide. The work is indexed by hand to bring successive sheets of mica in line with the cutter, and is held by hand as the cutter passes over it. Power is supplied to the cutter-spindle by a one-horsepower motor, which drives through bevel gears.

The mica dust produced by the cutter is a very fine powder; this formerly caused considerable annoyance to the department in which the machine is installed by floating in the air. To do away with this trouble, a standard vacuum cleaner was attached to the rear of the machine head, as shown at C, and the hose was connected to nozzle D, which is suspended directly over the milling cutter. The regular motor of the cleaner is employed for driving it. With this arrangement, all the fine mica dust is carried into the cleaner bag.

Time-saving Devices in the Landis Shop

IN Waynesboro, Pa.—a town somewhat removed from the through lines of travel—there are two well-known machine tool manufacturing plants, both identified by the name of Landis—the Landis Machine Co. and the Landis Tool Co. The Landis Machine Co. builds an extensive line of threading machines and dies for many purposes. The Landis Tool Co. builds grinding machinery. Both of the shops offer much of interest to the visitor of a mechanical turn of mind.

The present article describes a number of time- and labor-saving devices, tools, and fixtures employed in the shops of the Landis Machine Co., some of which, in addition to their efficiency, have the merit of insuring greater accuracy than is ordinarily obtained on the operations for which they are intended.

A Foolproof Indexing Fixture

Fig. 1 shows a fixture used for milling teeth in bevel ring gears, the main object of the fixture being to eliminate the use of the regular index-head, with its index-plate and numerous holes for the plunger of the index-lever. With the regular index-head, unless the operator takes great care, a mistake can easily be made by permitting the plunger to enter the wrong hole in the plate.

As will be seen from the illustration, instead of using a regular index-plate, two change-gears are used. The number of teeth in each is so selected that no matter what the number of teeth in the ring gear may be, one full turn of the index-lever moves the ring gear one space. The plunger in the index-lever strikes against a solid stop each time the operator gives the lever a full turn, so that no time is lost in finding the proper position for the lever.

Fig. 1. Fixture with Simplified Indexing Device for Milling Teeth in Bevel Ring Gears

To obtain the proper "roll-over" in milling the bevel gear teeth to the right shape, a screw in the back of the upper change-gear is loosened, and an index-plate on the back of this change-gear is moved until the screw fits into another hole, in which it is tightened. After this change has been made, the indexing proceeds again with full turns as described.

The fixture is mounted on the table of a Cincinnati milling machine, which moves back and forth automatically, actuated by the regular milling machine stops. The operator has nothing to do except to index each time the table reverses. As the indexing can be done very rapidly, he has ample time for the indexing movement. The ring gear shown in the illustration is a gear of 5 diametral pitch, with 184 teeth. With an ordinary indexing head, it required 3 1/2 hours to mill the teeth in this gear, whereas by the present method, a gear can be completed in slightly less than 2 hours.

Fixture for Milling Slots in Die-head Bodies

Fig. 2 shows a fixture for milling slots in stationary pipe die-head bodies, as applied to a Lucas boring machine. The radial spacing and the width of the slots must both be very accurate, the requirements being that the error in the angular position of the slots in a quarter turn shall not exceed a total of 0.005 inch at the outer circumference, and the width of the slots shall be so close to size that they will fit a standard gage (with no limits) without shake.

The fixture consists of an indexing table 36 inches in diameter, the whole construction necessarily being low, in order to be mounted on the boring machine. A regular index-head is used in connection with a worm and worm-gear having a ratio

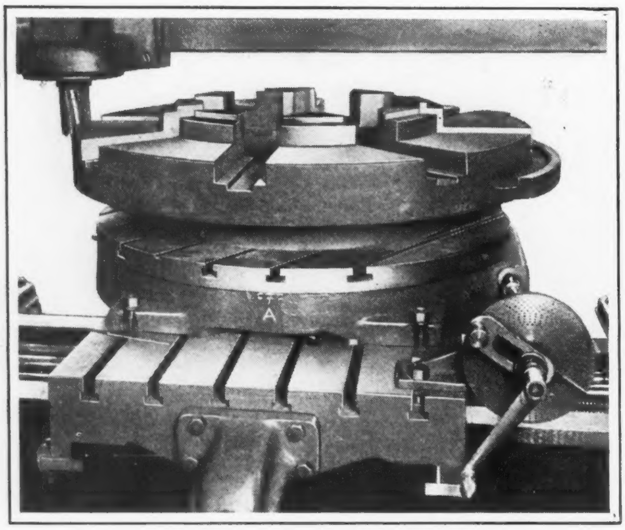


Fig. 2. Fixture for Accurately Milling the Slots in Stationary Pipe Die-head Bodies

of 260 to 1. An extension shaft is used on the worm to bring the index-plate well in front of the machine, and a large crank is used on the end of this shaft to make the device handy to operate. As will be seen, a pointer is provided at *A* and the lower edge of the circular table is graduated. These graduations, however, are not intended to be sufficiently accurate for the final setting, but are for general guidance only, to indicate to the operator when approximately the correct position has been reached. The final and accurate location of the slots is determined by the index-plate.

Turret Tool for Grooving Gear Blanks

In Fig. 4 is shown the tooling equipment on a Libby turret lathe for machining gear blanks. The tool of particular interest is the one in the foreground of the illustration, which is used for finishing the groove in the side of the gear blank in one operation. In the tool-holder shown, there are two tools, *A* and *B*, one of which finishes the groove on the outside next to the rim, and the other on the inside next to the hub. The two tools are so set that they overlap each other at the middle of the groove, and as they feed inward, the bottom of the groove is finished in one operation.

These tools are held in place in a rather interesting manner by wedge-shaped pieces *C*, which are pulled into the binding position by screws *D*. This method of binding the tools in place has been found very effective.

Fixture for Inspecting Cutters

In Fig. 3 is shown, at the right, a fixture for inspecting the cutters used for milling the chaser slides for pipe die-heads. One of these chaser slides is shown at *A*, and when milled, two angular cutters are used, mounted on the same arbor in approximately the position indicated in the illustration. As great accuracy is required, both in regard to the relative location of the milled surfaces and the shape of the angles, a special fixture was designed by which, through the use of accurate gage-blocks and a dial indicator, very accurate results are insured. As these cutters are used in pairs, a set of two gage-blocks is required for the inspection of each set of cutters. Below the fixture are shown two sets of these gage-blocks, the fixture being used for a great number of sets of cutters of different sizes.

The fixture is used directly in the grinding department to test the cutters when grinding. It is not a device for making direct measurements, but rather a comparator to insure that the relative size of the two cutters is accurate. It makes no difference what the exact dimensions of each cutter may be, so long as the relative size of the two cutters is according to the specifications, as may be easily seen by studying, in the illustration, the manner in which the cutters are used.

When the fixture is in use, one cutter is placed on the stud in the center of the fixture. Then a gage-block is placed with its angular end against it, while the other end abuts against the indicator dial, the needle of which is adjusted to point to

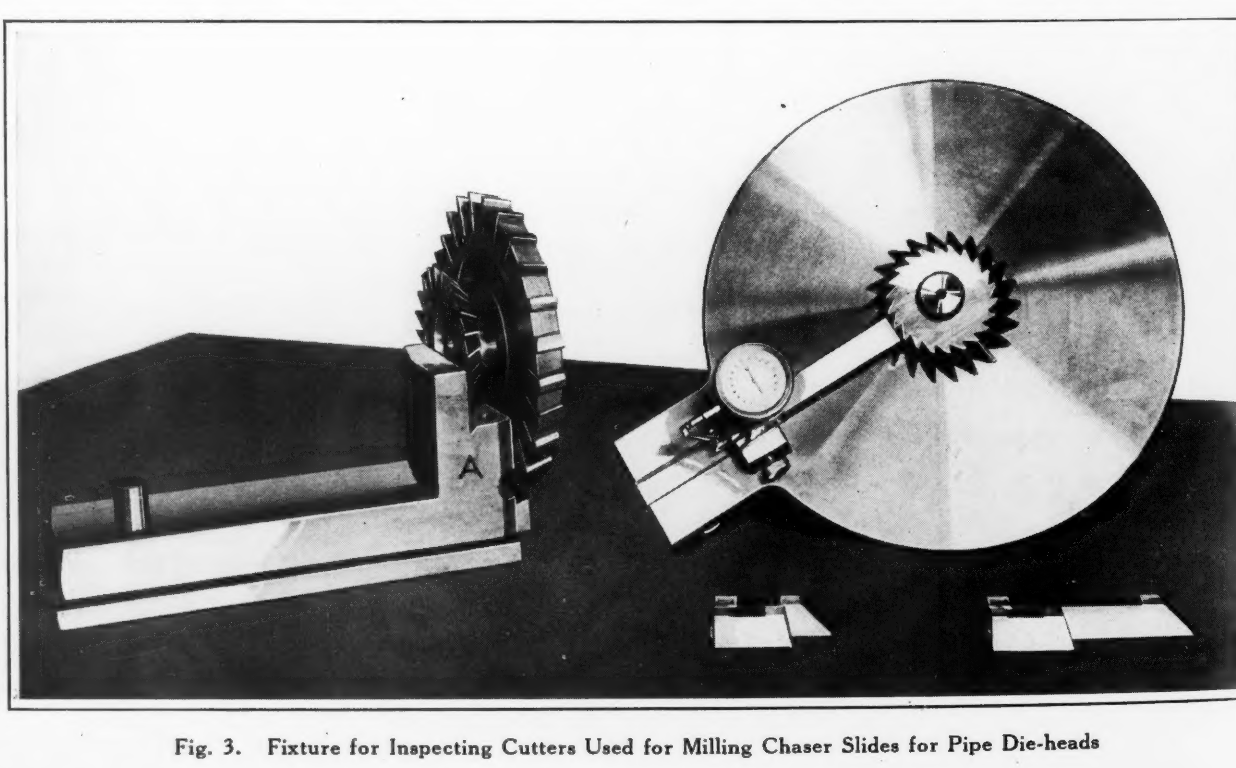


Fig. 3. Fixture for Inspecting Cutters Used for Milling Chaser Slides for Pipe Die-heads

zero. Now the other cutter in the set is placed on the stud and the other size block is placed between it and the dial indicator. If the relation between the two cutters is correct, the needle will point to zero. If it is not correct, the dial indicator will show exactly how great the error is. The size blocks, being ground with the required angle on one end, are also used as angle gages, to determine that the cutters have been ground to the correct angle.

Fixture for Boring Hole in Correct Location Relative to an Inclined Surface

Figs. 5 and 6 show an ingenious fixture which has been developed for boring hole *A*, Fig. 5, in automatic threading machine beds in correct relation to the inclined surfaces *B* and *C*. The under surface of the bed is not finished, nor is there any other horizontal surface on the bed of the machine from which it may be leveled; yet the hole must be bored not only in the right position with relation to the inclined surfaces on the bed, but also at the correct predetermined angle.

This is accomplished as follows: A fixture, as shown in Figs. 5 and 6, is mounted on the lower inclined surface. It is located by a finished pad or surface at the upper end of the inclined surface, which matches with a finished surface at the upper end of the fixture, the latter, so to speak, hooking over the end of the inclined surface. This locates the fixture in a definite position with regard to the inclined surface. The fixture is now clamped to the bed, and bushing *D* locates the hole in its correct location.

In addition, it is necessary to level the bed with the fixture mounted on it, so that the hole will be bored at the proper angle. As will be seen in the illustrations, a high-grade level is placed in two positions on finished spots on the fixture, there being three spots in all, two being used for the leveling operation shown in Fig. 5, and one of the same spots with the third one being used as shown in Fig. 6. The bed is placed on leveling jacks, as indicated in Fig. 5, which are adjusted until the level shows that the bed is in the proper position with the level in either direction, after which the hole may be bored with the assurance that it is correctly located relative to the inclined surfaces.

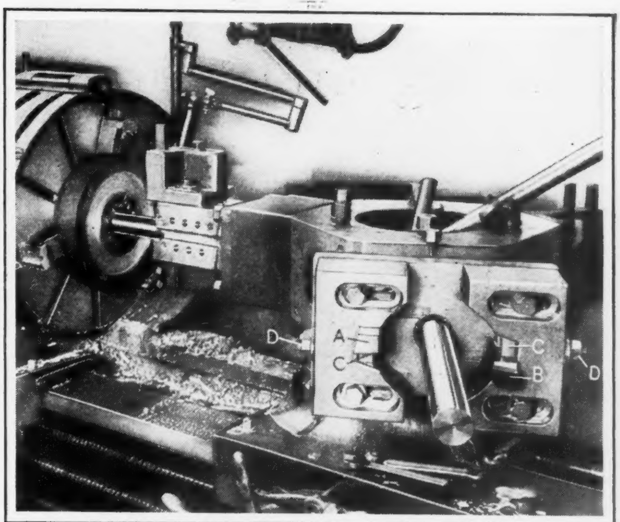


Fig. 4. Turret Lathe Tool for Finishing the Groove in the Side of a Gear Blank in One Operation

* * *

In connection with the fifty-year anniversary number of the *American Exporter*, it is mentioned that fifty years ago 83 per cent of all American exports went to Europe and 17 per cent to the rest of the world. Now, only 46 per cent goes to Europe and 54 per cent to the rest of the world.

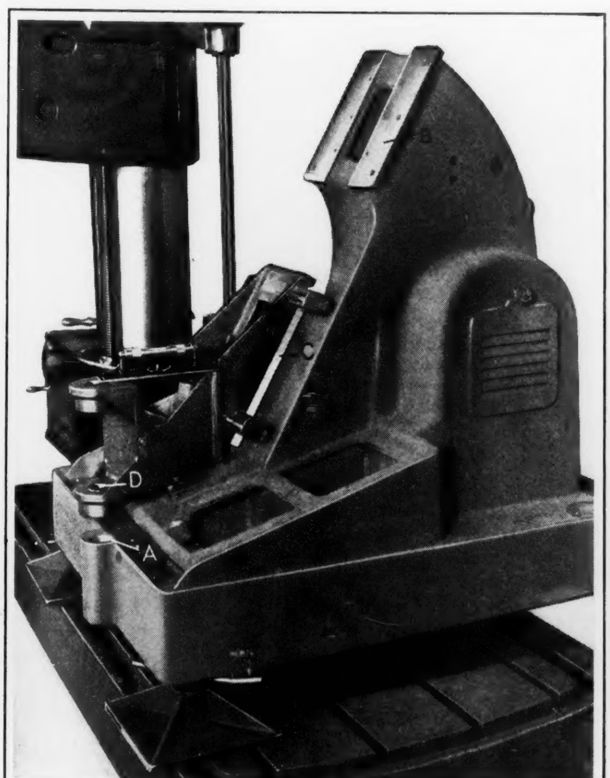


Fig. 5. Fixture for Boring Hole in Automatic Threading Machine Bed, with Level in Place

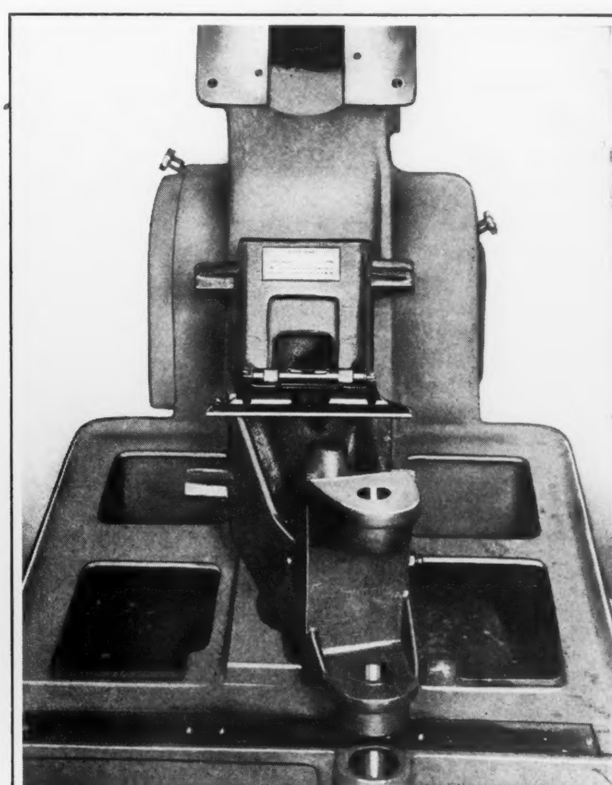


Fig. 6. Same Fixture, with Level Shown in the Second Position, Insuring Accurate Leveling of the Bed

Beading and Forming Oval Copper Jacket

By HERMAN SCHMID

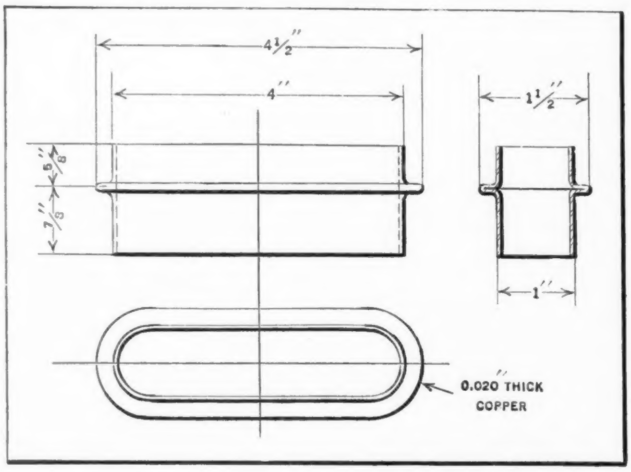


Fig. 1. Oval Copper Jacket with Deep Beading

MOST diemakers and designers are familiar with the construction of beading dies for short flanges such as are required on can covers. Satisfactory dies for this class of work can be easily constructed. The unusually wide bead and flange on the part shown in Fig. 1 and the thinness of the material present a more difficult die problem.

As the production on this part was not very high, it was necessary to keep the cost of the die and tools as low as possible. Copper tubing having a wall thickness of 0.020 inch and a diameter of 2 7/8 inches, cut into lengths of 2 inches, was obtained for making the jackets. These tubes were annealed and rolled on the beading rolls shown at *B*, Fig. 2. A little experimenting was necessary in order to find just the right amount of stock to allow for the bead.

It will be noted that there is a 1/2-degree taper on the roll flange. A slightly greater taper would probably be even more satisfactory. After beading, the work is again annealed. The die shown at *A*, Fig. 2, was designed for the second operation, in which it was required to bring the beaded tube to the oval shape shown in Fig. 1. To the writer's surprise, this die did not operate as anticipated. The bead was forced out of shape on the ends of the jacket, and wrinkles were formed in the center. Supporting the center by a solid core and rubber helped but little.

In order to overcome this difficulty, the die shown at *A*, Fig. 3, was designed. By having the stroke adjusted to spread the members *C* and *D* apart exactly the right amount, the pieces were formed to the required shape, ready for the next operation. The two die pieces *C* and *D*, having ribs that fit the work, are sliding fits in the iron die-shoe and are held down by the two plates *H*. Holes drilled in pieces *C* and *D* receive springs which are seated against flattened pins, one of which is shown at *E*. These springs normally press the members *C* and *D* together and hold them in the position shown. Four pins *F* which serve to locate the work from the outside are driven into holes in the plates *H* which retain the members *C* and *D*.

All working parts of the die are made of cold-rolled steel; the parts *C* and *D* and the punch or wedge member *G* are cyanide hardened. When the die is in operation, the workman simply places one of the beaded tubes over the members *C* and *D* where they are located by the pins *F*. On the down stroke of the press, the wedge-shaped punch *G* causes the members *C* and *D* to spread apart and form the copper tube into an oval-shaped jacket.

In the third operation, the oval-shaped jacket is placed in the die shown at *B*, Fig. 3, which flattens

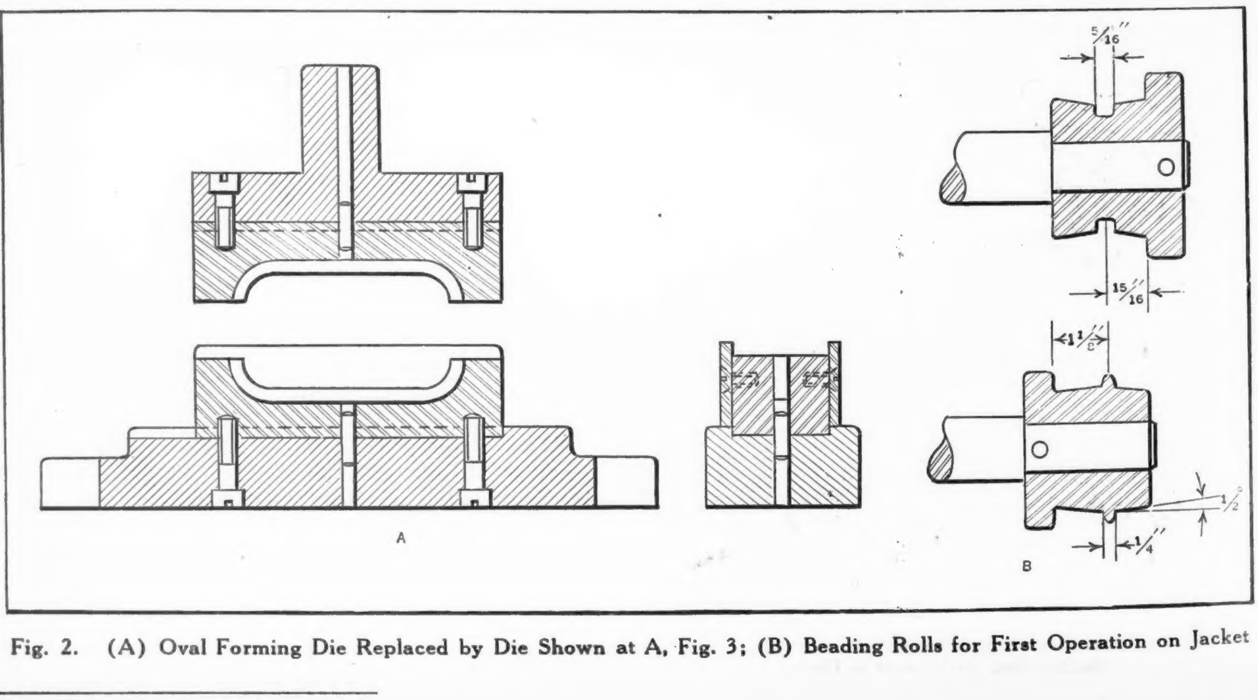


Fig. 2. (A) Oval Forming Die Replaced by Die Shown at A, Fig. 3; (B) Beading Rolls for First Operation on Jacket

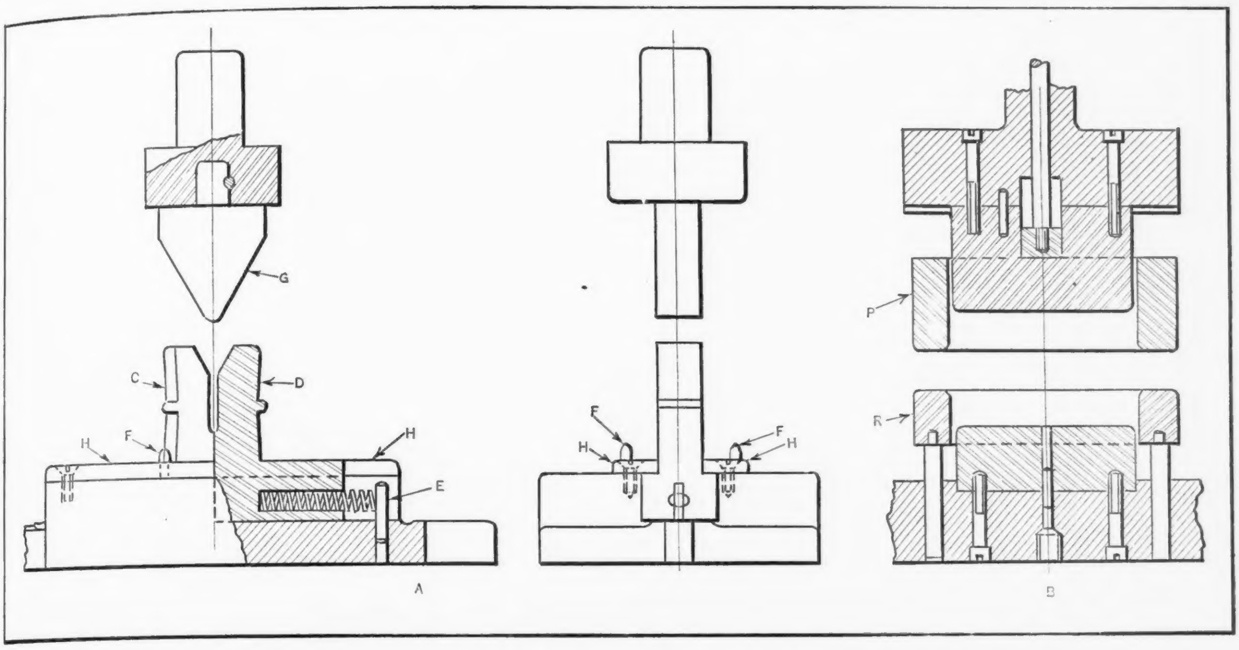


Fig. 3. (A) Die for Forming Oval Jacket from Cylindrical Tube; (B) Bead-flattening Die

out the ribs or bead made with the beading rolls in the first operation. The clearance between the core and the punch of this die and between the punch and the pad P is slightly greater than the thickness of the stock. The knock-out R works up and down on four pins which rest on the usual type of rubber or spring pad located below the die. The other details of the die are clearly shown in the illustration.

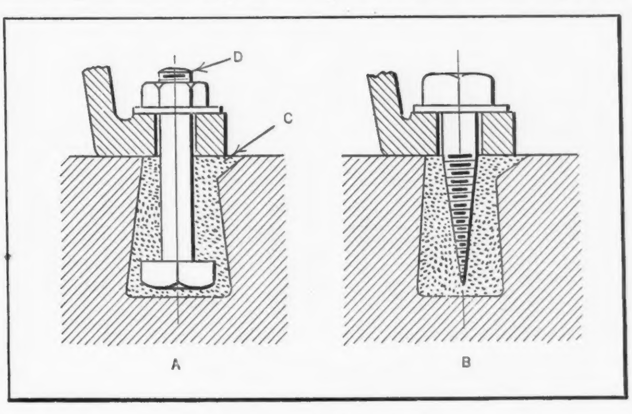
* * *

METHOD OF FASTENING MACHINE TO FLOOR

By EDWARD T. HEARD

The usual method of fastening machine bases to concrete floors is to make holes in the floor in the proper positions, place the hold-down bolts in these holes and pour concrete around them. The objection to this method is that the vibration of the machine often cracks the concrete and jars the bolts loose. Another method is to make holes in the concrete and drive wooden plugs into the holes. The lag screws used to hold the machine base down are then screwed into the wooden plugs. When this method is used, the vibration of the machine often cracks the wooden plugs or loosens the lag screws.

A better method of anchoring the hold-down bolt is shown at A in the accompanying illustration. With this method, a hole having a back taper is made in the floor, which lines up with the hole in the machine base. A groove is cut at C which reaches out beyond the outer edge of the machine base. The machine bolt D is then put in the hole in the machine base with its head in the tapered hole as indicated. Next a nut and washer are placed on the bolt and the machine placed in its proper position.



Methods of Fastening Machine to Concrete Floor

Molten lead is then poured into the hole through the groove C. When the lead has become cool, the nut is tightened, thus giving a fastening that cannot jar loose. At B is shown a similar method, employed when a lag screw is used. The molten lead, in this case, is poured in the hole around the lag screw. After the lead is cool, the lag screw is tightened, giving a fastening that will not be loosened by vibration.

* * *

RUST PREVENTION BY OAKITE

In a paper prepared by J. A. Maguire for the annual meeting of the staff and field representatives of the Oakite Products, Inc., oakite was recommended for the removal of soluble oils from machine parts. Work of this kind is generally inspected after cleaning, and it is stated that the oakite will not harm the inspector's hands. It is advisable not to rinse the work after cleaning, but to leave a film of the cleaning solution on it, as this will prevent rust.

It was also stated that for work to be painted, a rinsing solution to which a small amount of oakite has been added gives good results. Usually some period elapses between cleaning and painting, and if the surface is perfectly clean and unprotected it will corrode. The thin oakite film prevents rust and yet it is said never to have been known to interfere with the painting. Wherever difficulties have been observed with painted metallic surfaces, it is usually due to corrosion, or to the use of a paint that is not suitable for the purpose. The pieces ought to be wiped after the hot rinse, preferably with a damp rag, as they are otherwise likely to spot from the water drying on the work.

Notes and Comment on Engineering Topics

Wire rope that is used for constantly handling capacity loads should be of a 6 by 37 wire construction and should have a factor of safety of not less than 7—that is, the rated capacity of the hoist or crane should not cause a stress in the rope of more than one-seventh of the actual tensile strength of the rope.

The National Automobile Chamber of Commerce estimates that there are 2,700,000 families in this country who own two or more automobiles per family. The number of individuals and families with more than one car is constantly increasing, and automobile manufacturers expect a considerable proportion of future sales to come from this source.

Refrigeration of automobile trucks has been introduced with success in California for bringing perishable foodstuffs from some of the rather warm valleys to the nearby cities. It is reported that since this service was inaugurated last summer, it has proved a great success in hauls as long as 215 miles from the San Joaquin Valley to the coast.

Approximately 320,000,000 large size and 218,000,000 small electric incandescent lamps were sold in the United States in 1927. This is an average increase of 5 per cent over 1926. Incandescent lamps are now made with a capacity as high as 10,000 watts, these lamps having been developed for motion picture studio use. They are also widely used for aviation field lighting.

A temperature indicating instrument which shows differences of temperature of a millionth of a degree Fahrenheit is said to have been developed at the Bell telephone laboratories. The instrument is said to be a hundred times more sensitive than the most delicate instrument for this purpose hitherto developed. The change of temperature of a thousandth part of a degree Fahrenheit is sufficient to make a spot of light move rapidly across a scale.

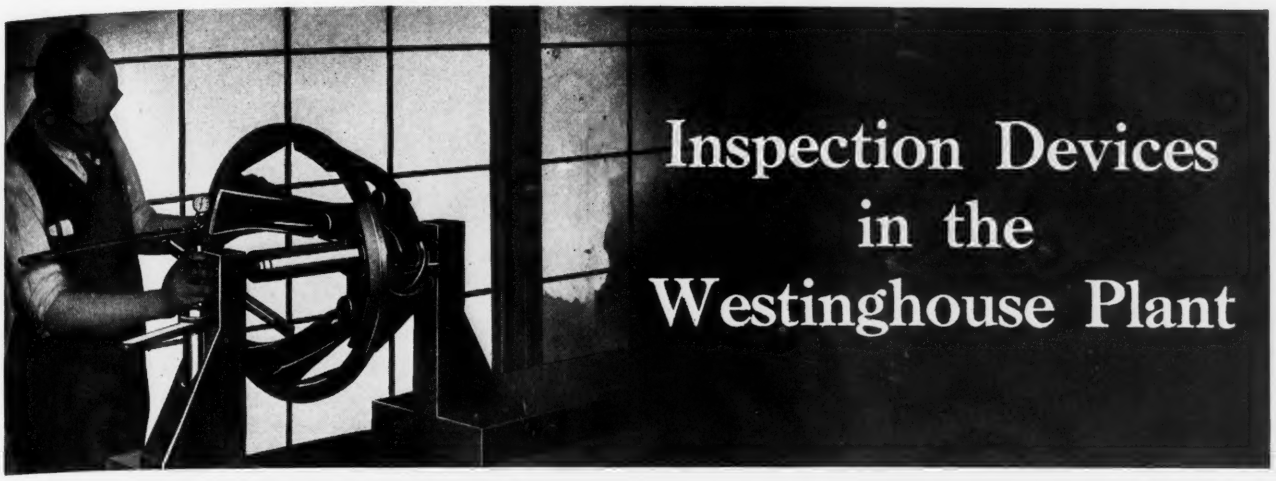
During the war a few reinforced concrete ships were built in the United States, but the venture apparently did not prove successful, for no reinforced concrete ships have been built since in this country. The Soviet Republic, however, has carried on experiments with concrete ships for the past few years, and recently a train ferry and ice breaker on the Volga River, built in this manner, was placed in operation. A large floating dock of reinforced concrete, with a lifting capacity of 6000 tons, is now being constructed in Leningrad. Russian engineers seem to expect great things from the use of reinforced concrete in ship construction.

Approximately 12 per cent of all motor vehicles in the United States are motor trucks. In all, there are over 2,760,000 trucks in use in this country. Trucks compete with railroads only for short-haul traffic, statistics showing that from 60 to 80 per cent of all motor truck trips are for distances of less than thirty miles. In different states, only from 5 to 19 per cent of all trips are for distances of sixty miles or more. The average trip mileage of loaded trucks ranges from twenty-three miles in Connecticut to thirty-one miles in California. Forty-six railroads are now using trucks in terminal operation, fifteen using them for store-door deliveries. Eleven railroads have replaced local freight trains with trucks.

The progress of electrification in the Soviet Union is one of the most outstanding of the economic accomplishments of that country. While the general industrial production in Russia is stated to have surpassed by a small margin the pre-war level, the production of electrical energy is about three times the pre-war figure. The annual output is now 2,100,000,000 kilowatt-hours, as compared with 690,000,000 kilowatt-hours in 1913. A continuous program of electric power plant building is being pursued. The population of the Soviet Union is estimated at close to 150,000,000 people, of whom over 75,000,000 are engaged in gainful occupations. Statistics show that 60,000,000 are engaged in agriculture, 5,000,000 in the industries, and 1,500,000 in transportation service.

At the annual meeting of the Society of Automotive Engineers in Detroit, R. J. Broege of the Buda Co., described an automotive compressorless, solid-injection, full-Diesel engine of the four-cycle type developed by the Maschinenfabrik Augsburg, Germany, for application to automotive vehicles. A 50-horsepower engine has been installed in a 4-ton truck, not as an experiment merely, but for observation from a practical operating standpoint. It has performed as well as a gasoline engine of the same bore in the same truck, with greater fuel economy and better pulling capacity. It can be easily handled and requires no more attention than a gasoline engine. An American-built four-cycle engine was also described, complying in general with the principles of the German engine.

These engines can be started by electric starters or by a two-cylinder air-cooled gasoline engine. The operation is completely controlled by two levers regulating the fuel pump, similar to the gasoline and spark controls on a gasoline engine. The entire construction is similar to the heavy-duty automotive-type gasoline engine. The weight per horsepower is practically the same, and about the same space is required for installation. The fuel pump replaces the magneto, and the carburetor is eliminated.



Inspection Devices in the Westinghouse Plant

By WILLIAM H. MILLER, Supervisor of Tools, Inspection Department, Westinghouse Electric & Mfg. Co.

APPROXIMATELY eight thousand special inspection devices are required in building electrical machinery and equipment at the plant of the Westinghouse Electric & Mfg. Co. A few of these were described in an article published in February MACHINERY; the present article will give a few more examples that possess features of general interest.

Two Adjustable Beam-type Gages

An adjustable length gage employed for checking the location of parts on assembled and partly assembled rotors is illustrated in use in Fig. 1. This gage is of a beam type, provided with four hardened blades which may be moved horizontally or vertically as required. The blades and the beam are graduated. The two end blades are constructed with V-rests which are placed on the armature shaft, so that the instrument can be accurately centered in relation to the rotor.

With the device on the armature shaft as illustrated, the location of different parts of the armature can be determined by the position of the long beam in relation to the graduations on the end blades, and by the horizontal and vertical positions of the center blades in relation to the long beam.

Fig. 3 shows a somewhat similar gage which is employed in checking the alignment of the coil slots in the core of a rotor with the key or keyway in the armature shaft. In this case, there are also two hardened end blades *A* on which the beam *B* is adjustable, both vertically and horizontally. Each end blade, in this example also, is constructed with a V-rest which is placed on the armature shaft when the device is being used. Fastened to the beam there is an accurate locating pin *C*, which is entered into the proper slot in the armature core for the inspection. Pointer *D* is then used for determining the position of the key or keyway in the shaft.

Spherical and Depth Gages for Bearings

Two gages of interesting construction are employed in checking bearings of the type shown at *A*, Fig. 5. For checking the bore to determine whether or not it is out of round or large in the center, accurate interchangeable plates *B* are fastened to handle *C*. By tilting this gage, it can be inserted in the hole, past burrs or similar obstructions, and then conveniently swung into the gaging position at the desired point. It is mentioned that this gage can be used more rapidly than a cylindrical plug gage or a pin gage.

For checking the depth of slot *D* in the bearing, a simple device is employed, which consists entirely of a foot *E*, placed on the wall of the bearing, and

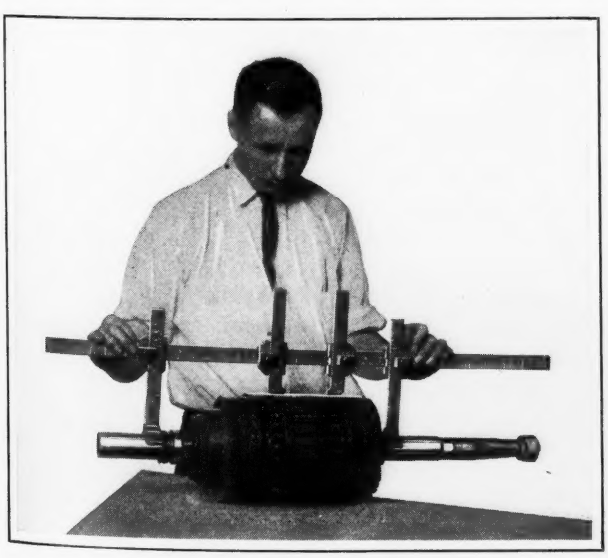


Fig. 1. Beam Type of Gage Used in Checking the Location of Various Parts of an Assembled Rotor

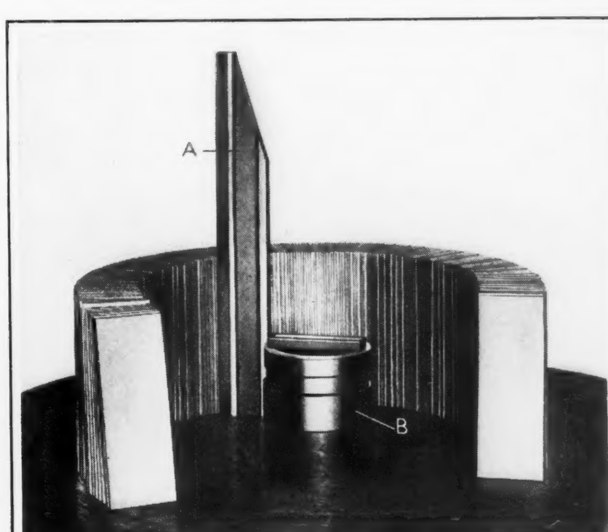


Fig. 2. Determining the Squareness of Commutator Bars prior to the Boring Operation

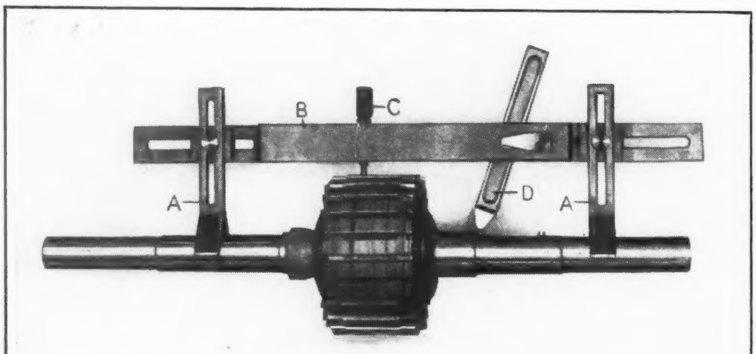


Fig. 3. Another Beam Gage Used in Checking the Alignment of Coil Slots with a Keyway

a graduated rod *F*. Rod *F* has two projecting fingers at the lower end, which are lowered into contact with the ends of the slot. The distance from the wall of the bearing to the ends of the slot can be determined by noting the graduation on bar *F* that coincides with the bottom of foot *E*.

Testing Device for Extension Springs

Extension springs used in small motors are tested for strength by means of the equipment illustrated in Fig. 6. Each spring is held in the machine for the test, as illustrated at *A*, with the upper end attached to a hook fastened to scale beam *B*. The lower end of the spring is connected to a hook fastened to a sort of pinion, which can be revolved by turning handle *C*, so as to stretch the spring any predetermined amount. The rack which operates the pinion (not visible in the illustration) is graduated, so that the amount of stretch can readily be determined. After the spring has been placed under tension, weights are added on the hook at the left-hand end of beam *B*, in order to check whether or not the spring can carry the load specified for a definite amount of stretch.

Fixture for Checking Various Drilling, Boring, and Milling Operations

A fixture for checking drilling, boring, and milling operations on a circuit-breaker frame is illustrated in Fig. 7. The fixture is used in checking the work between operations and after the part has been finished. Bar *B* is employed in checking two holes which are bored in line, while the five locating pins *C* are used for checking drilled holes. These locating pins are made 0.003 inch smaller in diameter than the size of the holes specified on the drawings, so as to provide a small tolerance for the drilling operation.

Feeler gage *A* is slipped between various surfaces of the fixture and corresponding surfaces of the work for checking the milling of the work surfaces. As these surfaces are milled with the part located in a fixture by means of the side holes, the holes are checked in the fixture shown in Fig. 7 before the milling operation is performed; hence, the gage is constructed with sufficient space between the walls to receive the unmilled castings. In checking the holes, the gage also serves to check the amount of stock on the various surfaces of the casting for the milling operation.

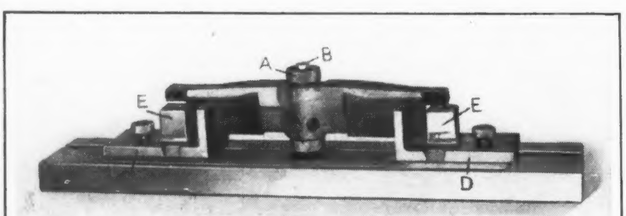


Fig. 4. Inspection Fixture for Checking Drilling, Profiling, and Milling Operations

Fig. 4 shows an adjustable gage used for inspecting moving contacts for circuit-breakers. This gage is used not only for checking the completed contact, but also for determining the accuracy of the work after the drilling, profiling, and milling operations.

The moving contact has a threaded hole at the center which is used in assembling it to the circuit-breaker. For the inspection, two threaded master bushings *A* are partly screwed into the hole from opposite sides. These bushings are then placed over a stationary pin mounted in the center of the fixture base, which may be seen at *B* projecting from the upper master bushing. The contact is further supported in the vees of rests *C* and *D*, which may be moved along the fixture base to suit the length of the work. The vees check the profiling operation on the contact, and rests with vees of various angles are interchangeable on the base.

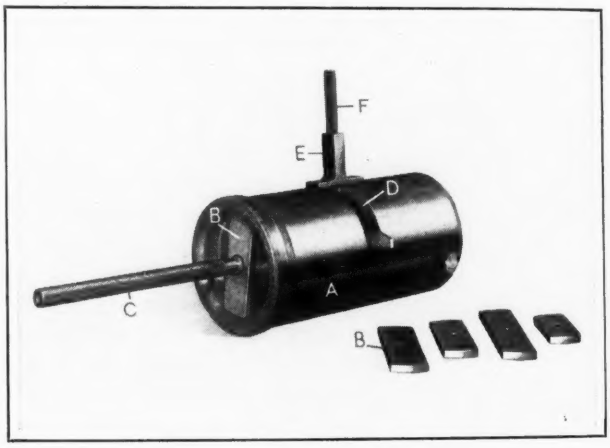


Fig. 5. Spherical and Depth Gages Employed in Checking Bearings

It will be noticed that each rest has a lug *E* in which an accurate hole has been drilled, reamed, and ground to receive a locating pin which is inserted in the hole through a drilled hole in the work. By this means the center-to-center distance of the holes in the work can be conveniently checked, as well as the alignment of the holes. The inner faces of lugs *E* also check the milling operation by determining the length of the major portion of the contact.

Checking the Squareness of Commutator Bars

Commutator bars and clamp rings are checked for squareness by means of the square *A* and holder *B* shown in Fig. 2. The commutator bars are stacked on a surface plate as shown; then, with the square and holder resting firmly on the surface plate, the front V-shaped edge of the square is

placed in contact with the bars. The square is of standard shape, except that it is somewhat thicker than usual and has the V-shape at the front edge. This device was designed to be used through the rough bore of bars assembled in a clamp ring. After the bars have been built up and the bore has been finished, the device is used again for inspecting the work before the subsequent operations are performed.

Device for Checking Flat Springs

An adjustable gaging device which is employed in checking the steel contact fingers for controller drums is illustrated in Fig. 8. This device checks both the tension and length of the spring at one setting. The spring *A* is held in position by means of the eccentric clamping lever *B*. Prior to the inspection, handle *C* is tilted to the right so that the lower bend of the spring may rest in the vee in the lower flat surface

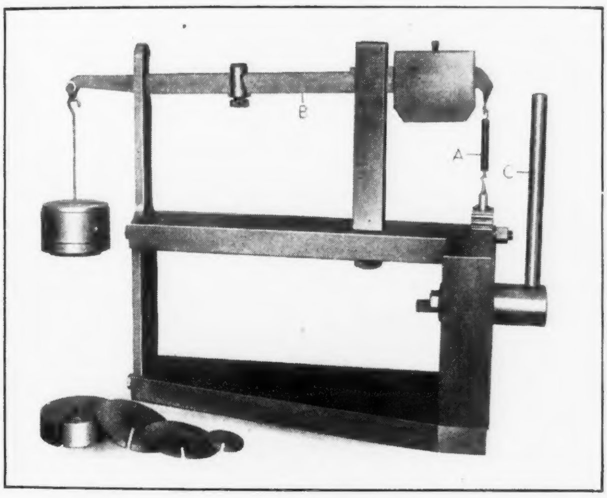


Fig. 6. Determining the Strength of Small Coil Springs under a Given Tension

of slide *D*. The length of the spring is determined by observing the position of this vee with respect to graduations on baseplate *E*. After the length of the spring has been determined, the tension is tested by moving slide *D* toward the left to bend the spring out of parallel as shown. If the tension is satisfactory, the spring will straighten out when released.

* * *

PROPOSED HACKSAW STANDARDIZATION

With the object of cooperating with the Department of Commerce in the elimination of waste, the Hacksaw Manufacturers' Association at a meeting held January 25 unanimously adopted recommendations for standardization. These recommendations have been submitted to the Department of Commerce, and through the Division of Simplified Practice, will be presented to the trade for comment and further action. Those interested in this subject may communicate with Ryland L. Lockwood, Division of Simplified Practice, Department of Commerce, Washington, D. C. The hacksaw manufacturers feel that the great variety of sizes now on the market impose an unnecessary cost on manufacturers, dealers, and users.

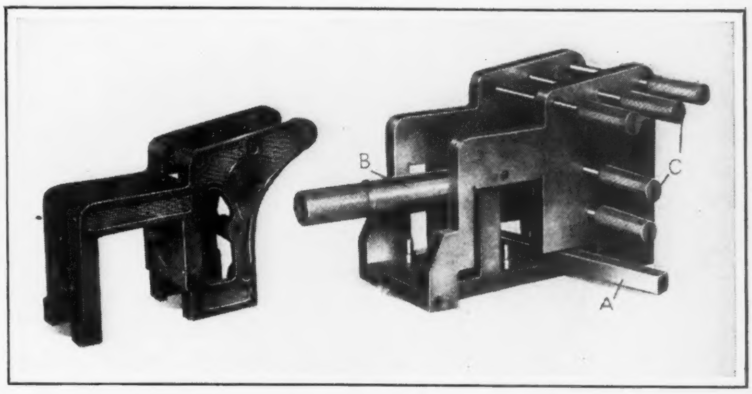


Fig. 7. Fixture for Checking Boring, Drilling, and Milling Operations on a Circuit-breaker Frame

MACHINEABILITY AND WEAR OF CAST IRON

In a paper presented before the annual meeting of the Society of Automotive Engineers, Thomas H. Wickenden of the International Nickel Co., New York City, stated that the hardness or chemical composition of cast iron is by itself no indication of the wearing properties and machineability of the metal. Cast irons containing a large amount of free ferrite have been found to wear rapidly, whereas others having considerable pearlite or sorbite in their structure show good wearing properties. The presence in cylinder blocks of excess-carbide spots or of phosphides of high phosphorus content is deleterious, because such spots wear in relief and the material ultimately breaks out, acting as an abrasive that scores the surface of the piston and cylinder walls.

Causes of wear in cylinder blocks were discussed, and nickel, or nickel and chromium, intelligently added to the iron, was suggested as a means of obtaining the correct microstructure for a combination of good wearing properties and machineability. Since greater hardness is the result of a harder matrix rather than of an increase in the number of carbide spots, it has been found to be a good index of the improved resistance to wear, and to overcome the difficulty from the valves hammering into their seats.

Analyses of cylinder blocks, pistons, clutch plates, brake-drums, cams, and forming dies, in which nickel and chromium have been used, were given, and the improvements secured in the performance of these parts were described.

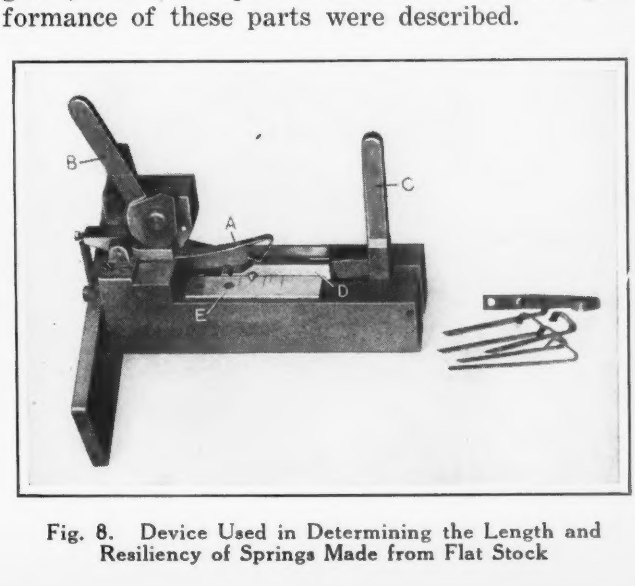


Fig. 8. Device Used in Determining the Length and Resiliency of Springs Made from Flat Stock

STELLITING INCREASES LIFE OF HOT-DRAWING DIE

Stelliting the edges of hot or cold cutting and forming dies and surfacing machine parts subject to excessive wear by means of the oxy-acetylene blow-pipe is a comparatively recent development. Fig. 1 shows two carbon-steel hot-drawing dies, the edges of which have been stellited. The rings are used by the Harrisburg Pipe & Pipe Bending Co. in a finishing bench, Fig. 2, for drawing steel oxygen cylinders. The used ring *A*, Fig. 1, gave a run of 822 cylinders on the original grinding. It shows fire cracks, which cannot be avoided, but these are not objectionable so long as no pieces fall out. After the die is worn too large or the base metal is reached, the diameter is trued up and the surface re-stellited. This operation is repeated over and over again. The only thing that wears out is the stellite, and when this is renewed, about the same length of service is obtained as from the original surfacing.

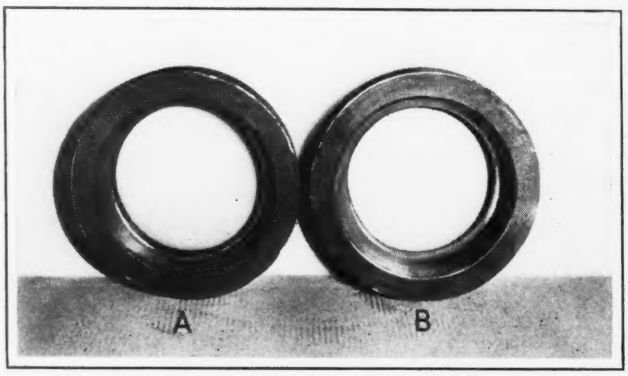


Fig. 1. (A) Stellited Die Used in Drawing 822 Oxygen Cylinders; (B) Die Newly Stellited and Ground

The dies illustrated are subjected to hard service, as they are used in the last stage of the finishing bench, which contains three rings of successively smaller diameter. The first and second rings in the bench yield as high as 2000 cylinders before requiring resurfacing. The service from the last ring runs from 200 to 800 cylinders before re-stelliting is necessary.

The die formerly used was made of chilled iron containing about 3 per cent chromium, and yielded 30 to 40 cylinders. Then it was reground to a larger internal diameter and used in an earlier stage of the process. Other difficulties with the chilled iron dies were that they became rough and out of round and were sometimes very difficult to remove from the holders without breakage. It can be readily seen that stelliting, in this case, effected a large saving.

* * *

The exports of automobiles and trucks have steadily increased from year to year ever since 1920. It is expected that in 1928, Europe alone will absorb 150,000 American automotive vehicles.

INVERTING CUTTING-OFF TOOL TO STOP CHATTER

By W. R. WARD

The writer read with interest the article entitled "Do You Have Trouble with Cutting-off Tools?" on page 290 of December MACHINERY. While working in a steel mill the writer was told of the following method of cutting off stock, which he has found very satisfactory. The cutting-off tool is inverted in the toolpost of the lathe and clamped in place with its cutting edge at nearly the same height as the center of the spindle or work. The lathe spindle is then run backward.

This method has proved successful in cutting off rings from large steel forgings when using a comparatively small lathe. With this method the tool is forced away from the work instead of being drawn into it, thus eliminating chatter which results from the digging in of the tool. The lost motion or backlash in the cross-head screw, thrust collar, and slide allows the tool to dig in if it is not properly adjusted when using the ordinary method. With the tool reversed, all backlash is taken up before the tool begins to cut. Under the latter condition, the tool produces long curling chips, as compared with the short splintery chips that are generally produced by a chattering tool.

* * *

DIE FOR TIN FOIL

By CHARLES KUGLER

In making a punch and die for cutting tin foil about 0.0015 inch thick, it was the practice to leave the punch soft and shear it in the hardened die to obtain a tight fit. After grinding one of these dies carefully and shearing the punch in, the writer was still unable to make the die cut clean. It was found, after experimenting, that the burr raised by the grinding wheel on the cutting edge of the die caused more metal to be sheared from the punch, making it too small. Hence, all the burrs on the die were removed with an oilstone before shearing the punch. After this had been done, the sheared punch cut clean. The end of the punch was enlarged by peening before shearing it into the die.

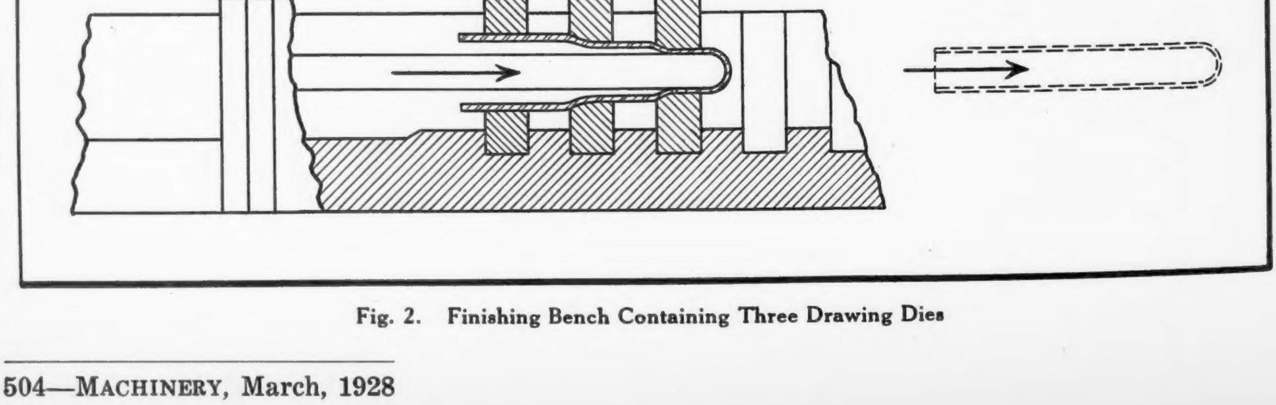
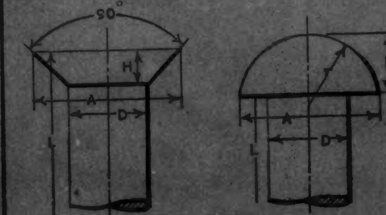


Fig. 2. Finishing Bench Containing Three Drawing Dies

MACHINERY'S DATA SHEETS 125 and 126

AMERICAN STANDARD SMALL RIVETS—1



Countersunk   Button Head

American Standard Approved by American Engineering Standards Committee, Society of Automotive Engineers, and the American Society of Mechanical Engineers.

Countersunk-head Rivets

Diameter of Body D			Diameter of Head A	Depth of Head H	Included Angle (Deg.)	Tolerances, Body Diam.	
Nominal	Maximum	Minimum				Plus	Minus
3/32–0.094	0.096	0.090	0.176	0.040	90	0.002	0.004
1/8–0.125	0.127	0.121	0.231	0.053	90		
5/32–0.156	0.158	0.152	0.289	0.066	90		
3/16–0.188	0.191	0.182	0.346	0.079	90	0.003	0.006
7/32–0.219	0.222	0.213	0.407	0.094	90		
1/4–0.250	0.253	0.244	0.463	0.106	90		
9/32–0.281	0.285	0.273	0.520	0.119	90	0.004	0.008
5/16–0.313	0.317	0.305	0.577	0.133	90		
11/32–0.344	0.348	0.336	0.635	0.146	90		
3/8–0.375	0.380	0.365	0.694	0.159	90	0.005	0.010
7/16–0.438	0.443	0.428	0.808	0.186	90		

All dimensions given in inches. Approximate proportions: $A = 1.830 \times D$, and $H = 0.425 \times D$. Length L to order.

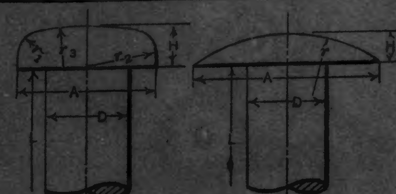
Button-head Rivets

Diameter of Body D			Diameter of Head A	Height of Head H	Radius of Head r	Tolerances, Body Diam.	
Nominal	Maximum	Minimum				Plus	Minus
3/32–0.094	0.096	0.090	0.166	0.071	0.084	0.002	0.004
1/8–0.125	0.127	0.121	0.219	0.094	0.111		
5/32–0.156	0.158	0.152	0.273	0.117	0.138		
3/16–0.188	0.191	0.182	0.327	0.140	0.166	0.003	0.006
7/32–0.219	0.222	0.213	0.385	0.165	0.195		
1/4–0.250	0.253	0.244	0.438	0.188	0.221		
9/32–0.281	0.285	0.273	0.492	0.211	0.249	0.004	0.008
5/16–0.313	0.317	0.305	0.546	0.234	0.276		
11/32–0.344	0.348	0.336	0.600	0.257	0.304		
3/8–0.375	0.380	0.365	0.656	0.281	0.332	0.005	0.010
7/16–0.438	0.443	0.428	0.765	0.328	0.387		

All dimensions given in inches. Approximate proportions: $A = 1.750 \times D$; $H = 0.750 \times D$; $r = 0.885 \times D$. Length L to order.

MACHINERY'S Data Sheet No. 125, New Series, March, 1928

AMERICAN STANDARD SMALL RIVETS—2



Pan Head   Truss or Wagon Box

American Standard Approved by American Engineering Standards Committee, Society of Automotive Engineers, and the American Society of Mechanical Engineers.

Pan-head Rivets

Diameter of Body D			Diameter of Head A	Height of Head H	Radii of Head		
Nominal	Maximum	Minimum			r_1	r_2	r_3
3/32–0.094	0.096	0.090	0.163	0.054	0.030	0.080	0.326
1/8–0.125	0.127	0.121	0.215	0.072	0.039	0.106	0.429
5/32–0.156	0.158	0.152	0.268	0.089	0.049	0.133	0.535
3/16–0.188	0.191	0.182	0.321	0.107	0.059	0.159	0.641
7/32–0.219	0.222	0.213	0.378	0.126	0.069	0.186	0.754
1/4–0.250	0.253	0.244	0.429	0.143	0.079	0.213	0.858
9/32–0.281	0.285	0.273	0.482	0.161	0.088	0.239	0.963
5/16–0.313	0.317	0.305	0.535	0.178	0.098	0.266	1.070
11/32–0.344	0.348	0.336	0.589	0.196	0.108	0.292	1.176
3/8–0.375	0.380	0.365	0.644	0.215	0.118	0.319	1.286
7/16–0.438	0.443	0.428	0.750	0.250	0.137	0.372	1.500

All dimensions given in inches. Tolerances for body diameter D same as given below for truss rivets. Approximate proportions: $A = 1.720 \times D$; $H = 0.570 \times D$; $r_1 = 0.314 \times D$; $r_2 = 0.850 \times D$; $r_3 = 3.430 \times D$. Length L to order.

Truss or Wagon-box Head Rivets

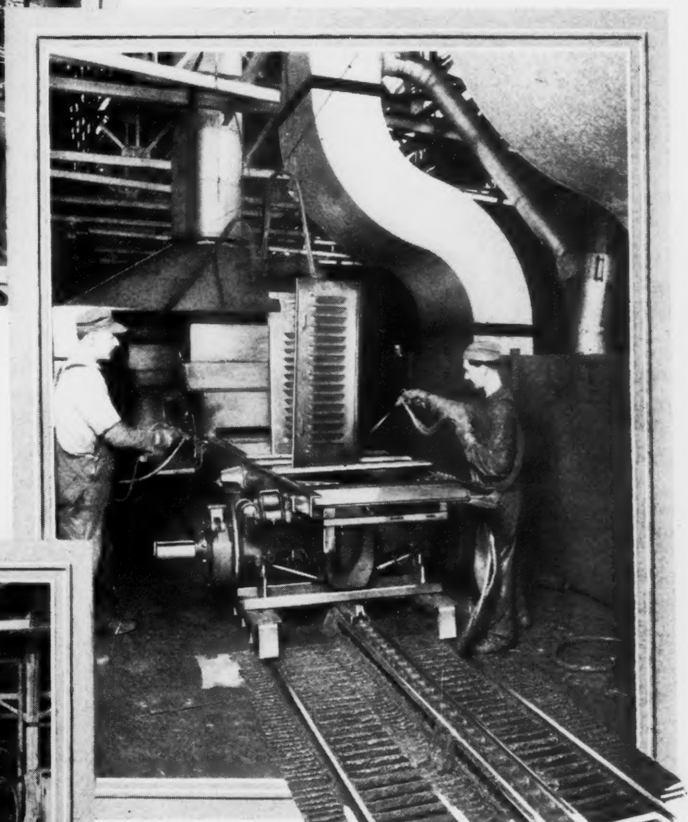
Diameter of Body D			Diameter of Head A	Height of Head H	Radius of Top r	Tolerances, Body Diam.	
Nominal	Maximum	Minimum				Plus	Minus
3/32–0.094	0.096	0.090	0.238	0.032	0.239	0.002	0.004
1/8–0.125	0.127	0.121	0.313	0.042	0.314		
5/32–0.156	0.158	0.152	0.390	0.052	0.392		
3/16–0.188	0.191	0.182	0.468	0.062	0.470	0.003	0.006
7/32–0.219	0.222	0.213	0.550	0.073	0.555		
1/4–0.250	0.253	0.244	0.625	0.083	0.628		
9/32–0.281	0.285	0.273	0.703	0.094	0.706	0.004	0.008
5/16–0.313	0.317	0.305	0.780	0.104	0.784		
11/32–0.344	0.348	0.336	0.858	0.114	0.862		
3/8–0.375	0.380	0.365	0.938	0.125	0.942	0.005	0.010
7/16–0.438	0.443	0.428	1.093	0.146	1.098		

All dimensions given in inches. Approximate proportions: $A = 2.500 \times D$; $H = 0.330 \times D$; $r = 2.512 \times D$.

MACHINERY'S Data Sheet No. 126, New Series, March, 1928

Progressive Assembly of White Trucks

A Chain Conveyor Carries the Chassis Along Automatically



(Above) Lowering Motor to Its Place in the Frame. (Right) A Chassis that has Just Come from the Cleaning Booth being Sprayed with Paint. (Below) A Completed Chassis Leaving the End of the Assembly Line with Gasoline in Its Tank and Operating Under Its Own Power, Ready for Road Tests

IN the plant of the White Motor Co., Cleveland, Ohio, the progressive assembly method of the frame and chassis is employed. First, the exact location of every hole that must be drilled is determined by means of two large layout fixtures. The frame then moves along and is drilled —not punched—thereby avoiding the usual strain set up in metal by punching. Brackets, hangers, and other machine details are then bolted to the frame, checked for alignment, and the frame is made ready for riveting. The rivets are heated by electric rivet heaters. After riveting, the frame is transferred to the chassis.

Springs and axles are bolted to the frame at the beginning of the line. As the chassis moves on, the steering stem, engine, radiator, and dash are assembled in their places. The chassis is then transferred to a second line, which takes it through the cleaning booth, after which it is sprayed with paint.

After painting, the chassis passes through a long drying oven. Its passage through this oven takes one hour and twenty minutes. From here the chassis enters the third stage of the assembly line, where at various points the electrical equipment, hood and fenders, etc., are attached. At the end of the line the chassis is driven off under its own power, its tank being filled with gasoline while it moves along the chain conveyor. All the operations are inspected as they pass along the assembly line, and in addition there is a final inspection before shipment.

Current Editorial Comment

In the Machine-building and Kindred Industries

PROGRESS OF ELECTRIC WELDING

During the past five years electric welding probably has made greater advances than any other process or method in the mechanical industry. It is not a new art, but its wide application was not recognized by most manufacturers and engineers until a few years ago.

The first discovery of the possibility of electric welding was made by Professor Thomson in 1877—more than fifty years ago—and the first actual machine for performing welding operations was built eight years later by the Thomson-Houston Electric Co. The application of electric arc welding is of more recent origin, but has developed with remarkable rapidity.

One of the latest processes is the projection method of welding. In one case 700 parts are welded per hour, each part having six welds, all made simultaneously. In spot welding, a speed of 300 spot welds per minute has been attained, while not long ago, a speed of 70 welds per minute was considered exceptionally good.

There is no doubt that electric welding will be applied to an ever-increasing extent in the future. The different processes of joining metals each have their own field and supplement, rather than compete with, one another. Gas welding, for instance, has its distinct application, as have the older methods for joining metals. The new methods do not necessarily supplant the old, but rather open up entirely new fields of application.

* * *

Good Machines Need Good Tools

To equip a shop with high-production machine tools and then furnish the manufacturing departments with inferior taps, drills, milling cutters and other tools, results in a loss on the entire investment. Only by a combination of the best machines with the best tools, is it possible to obtain the full working capacity from a modern high-power machine tool. It is pure waste trying to save a little in the first cost of metal-cutting tools, because the difference in the cutting capacity between inferior tools and the best is so great that the slight difference in price never justifies the apparent saving.

THE BASIC IDEA OF MACHINE DESIGN

A correspondent of MACHINERY justly says that the most important development of our mechanical age consists in the design of machines in which the skill of the craftsman is transferred from the man to the machine. Without this transfer of skill, the mass production which characterizes our present industrial era would be impossible.

Machine designers should give this point careful thought, because it will help them to obtain a new conception of their work. Many machine designers and machine users do not fully realize that the fundamental idea underlying the design of all high-production machinery is the transfer of skill in performing an operation from the hands of man to a mechanism of iron and steel.

For this reason the machine designer should ask himself if any manual skill is required in performing the machining operation under consideration, that can be transferred to the machine. If this analysis is applied to his problem at the beginning, much haphazard designing work may be avoided, for the designer will start with a definite instead of a hazy idea of what he is trying to accomplish.

* * *

EFFICIENT PLANNING PAYS

Careful planning and scheduling of production is one secret of profit in the manufacturing industries. Although a well designed product and other factors are highly important, an efficient planning department is needed to fit them together.

Such a department devoted exclusively to "stock chasing" is not worthy of the name, for stock chasing is made necessary by inadequate planning—it is hindsight instead of foresight. Hindsight is costly. Often elaborate set-ups must be torn down so that the machine may be used to rush some part of which there is a shortage, while men in the assembling department stand idle. Efficient planning requires that the sequence of operations be predetermined, and it involves providing for the fullest possible employment of all machine equipment.

A real planning department must be given the necessary authority to obtain the results for which it is responsible. It should prescribe what work shall be done and when, coordinate all departments, and plan all work.

* * *

TYPOGRAPHICAL DISPLAY

However clearly a circular or folder may present a selling argument or describe the machine or device offered for sale, it brings no results unless it is read. To make sure that it is, use clear legible type, so arranged that it can be read without effort, leaving the reader free to concentrate his attention on the contents of the printed message. Too long a line is not easy to read, and if the page is wide and the type comparatively small, it is advisable to set the matter in two columns rather than in one line running entirely across the page. A line seven inches long, in the type used in MACHINERY'S reading pages, would be more difficult to read than the same type set in double column.

Very large type, of course, permits the use of a longer line, but it is easier to err on the side of making the line too long than too short. When the eye is not required to move perceptibly from left to right and back again, but can simply move down the column, the best condition has been attained.

The Motor Bus Creates a New Industry

By MYRON E. FORBES, President and General Manager, Pierce-Arrow Motor Car Co., Buffalo, N. Y.

THE motor bus industry is no longer an adjunct to the automobile industry. It is a great industry all by itself. This has come about because the motor bus is a builder of new business and not merely a substitute for established forms of transportation. Not only has it created new business in territories already served by steam roads and electric railways, but it has made commercial transportation possible on thousands of miles of highways throughout the country, linking together cities and villages that formerly had no organized transportation system at all.

This is simply a repetition of the history of transportation. When railroads were being developed, the steamboat interests feared that people would no longer travel by river and lake; yet, the steamboat business of today is greater than ever. When the automobile appeared, the railroads were apprehensive as to the effect on railroad travel. Instead of decreasing, however, the railroad passenger business has increased, except on short runs, which were never very profitable to the railroads.

Myron E. Forbes, President and General Manager, Pierce-Arrow Motor Car Co.

Now the motor bus has arrived and taken its place as a recognized means of transportation—not as a mere substitute. What has happened? Some of the railroads have already discovered that when properly regulated and controlled, the motor bus, instead of depriving them of business, is a means of creating business. They have discovered that the motor bus can be made to serve as a profitable adjunct to the railroad, and today the railroads of the country use over 2000 motor buses, a figure which is growing every day. Probably it will be doubled, if not tripled, before the end of the year.

A mere glance at the history of transportation is sufficient to show why the motor bus creates business. It will be seen that in all cases, as fast as additional means of pleasant, safe, and rapid transit were offered, the public utilized them—traveling just that much more.

How many miles a year did the average man travel in the vehicles of the year 1800? Would 100 miles be a fair guess? Now nothing is thought of traveling 5000 or 10,000 miles a year in automobiles, and most people travel 1000 or 2000 miles, in addition, on railroads. In a similar way, motor buses induce millions of people to travel thousands of miles a year—much of it in addition to their use of the already established means of transportation.

The development of the motor bus has been most remarkable. The latest motor coach is longer and lower. It is more stable and rides more easily. No longer is a top-heavy body, mounted on a truck chassis, called a motor bus. The present-day motor coach more and more resembles the Pullman observation car. The windows are broader, the interior appointments are both practical and beautiful, and 100-horsepower, six-cylinder engines, running as quietly and smoothly as the engine in the finest private motor car, provide power without vibration.

The demand for motor buses has created a well established industry. Automotive manufacturers with many years of experience behind them will continue to constitute the backbone of the motor bus manufacturing industry, as they have gained invaluable experience during years of pioneering. Furthermore, the buyer of motor buses will require evidence of the stability of the maker of the buses he is using. He must have confidence in the maker's financial responsibility, and must feel sure that the manufacturer is in the motor bus business to stay.

At the present time there is some conflict concerning the question as to who shall furnish bus transportation. The future only will answer this question, but many states have already recognized, by legislative action, the necessity for protecting those who have had the courage to invest in motor bus equipment and provide the public with an added means of necessary transportation.

From present indications, motor bus transportation in the United States is limited only by the availability of highways. Just as the automobile was responsible for the demand for good roads, so the establishment of motor bus lines requires additional adequate highways, which will prove a spur to states and communities. While the number of miles of good roads in the United States now reaches an amazing total, there yet remain vast territories that have nothing but gravel "pike" and dirt roads. In the vast territories where steam and electric railways cannot be built because of excessive expense, good highways will make it possible to establish motor bus lines that will connect every city and village throughout the country. The motor bus will break down the last barrier to the frontier of isolation.

* * *

MEETING OF STEEL TREATING SOCIETY

The first semi-annual meeting of the American Society for Steel Treating was held in Montreal, Canada, February 16 and 17, with headquarters at the Mount Royal Hotel. Five technical sessions were held, at which fifteen papers relating to the field covered by the society were read and discussed.

Among the papers of especial interest to mechanical men in general may be mentioned "Steels for Case Nitrification," by A. B. Kinzel, Union Carbide & Carbon Research Laboratories, Long Island City, N. Y.; "The Manufacture of Stainless Steel Castings in the Various Industries," by V. T. Malcolm, Chapman Valve Mfg. Co., Indian Orchard, Mass., and V. O. Homerberg, Massachusetts Institute of Technology, Cambridge, Mass.; "Hardness Testing," by H. M. German, Universal Steel Co., Bridgeville, Pa.; "Heat-treatment of Forgings and Castings for Selective Directional Adjustment of Residual Stresses," by W. J. Merten, Westinghouse Electric & Mfg. Co., East Pittsburg, Pa.; "Some General Thoughts on Fusion Welding," by S. W. Miller, Union Carbide & Carbon Research Laboratories, Long Island City, N. Y.; "Types of Failure of Steel," by Robert Job, Milton Hersey Co., Ltd., Montreal, Canada; "Some Failures of Locomotive Parts and Study of Same under the Microscope," by F. H. Williams, Canadian National Railways, Montreal, Canada; "Alloy Steel for Boilers," by Charles McKnight, International Nickel Co., New York City; "A Note on the Hardness and Impact Resistance of Chromium-Nickel Steel," by B. F. Shepherd, Ingersoll-Rand Co., Phillipsburg, N. J.

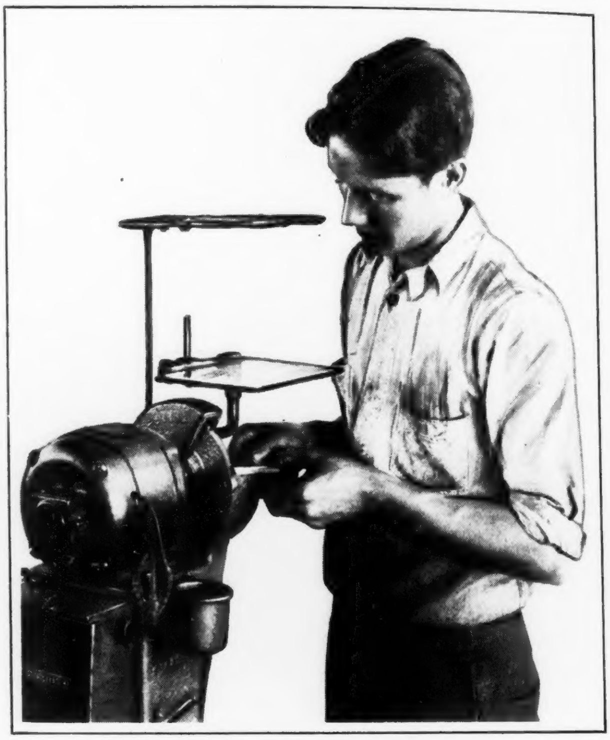
* * *

SPECIFICATIONS FOR HACKSAW BLADES

The Federal Specifications Board, Bureau of Standards, Washington, D. C., is adopting and promulgating purchase specifications for commercial products bought by the various departments of the United States Government. These specifications are submitted to representative manufacturers for their comment and criticism, and comment is also invited from anyone else who might be interested in the subject. The board has just issued proposed specifications for hacksaw blades; these may be obtained by anyone interested in the subject from the Federal Specifications Board at the address given.

IMPROVED SAFETY SHIELD FOR GRINDERS

An improved method of mounting glass shields for grinders is being used by the General Electric Co. in some of its plants. Heretofore, the glass shields were mounted at an angle over the work, and the workman looked directly through the glass. With this arrangement, reflections in the glass made it almost impossible to see the tool. A



New Method of Mounting Grinding Wheel Eye Shield

further disadvantage of this method of mounting was that the glass often became spattered with water and emery.

By placing the glass horizontally, as shown in the illustration, these difficulties were overcome. The only reflection in the glass is that of the guard directly above it. The guard, being black, reflects no light in the glass and is, therefore, no obstruction to vision. The guard is bound with rubber hose to prevent injury to the workman should he strike against it.

A further advantage of this method of mounting is that it shields the workman's eyes against any particles which may fly from the side of the wheel as well as from the front. The method of mounting shown was found to be the only one that gave clear vision at any angle and also shielded the eyes. The new shields were made over from the old type that were used in the angular position.

* * *

WELDED PARTS IN NEW FORD CAR

The increasing use of welding in automobile manufacture is demonstrated by the fact that a large number of parts on the new Ford car are constructed by arc welding. Among these welded parts are the rear axle housing, the steering gear casing, the radius rod, the spare tire carrier, the drag link for the front axle, and the axle rods. It is said that experiments are now under way preparatory to welding several other parts in addition to these.

Machine Tool Pulleys

By FRED HORNER

THE belt pulley is used as the primary element in a vast number of machine tools, for driving and feeding purposes, even in cases where the motor serves as the power unit. The construction and application of pulleys is, therefore, of vital importance, and power losses, combined with the reduction of output, may easily result from the use of inefficient or incorrectly applied pulleys. Belt slippage has recently been given more careful consideration, with the result that more efficient power transmitting arrangements have been developed, with, in some cases, improved belt-tightening devices of adjustable or automatic types.

The subject of pulleys for machine tools may be considered under three main divisions—namely, the construction of the pulley; its method of attachment or connection with the shaft or spindle; and its combination with other driving members, such as clutches, gears, and brakes. The construction is affected largely by the particular requirements of the machine tool, which generally are of a very different character from those of any ordinary machine. Consequently, although cast iron, wood, stamped steel, or built-up wrought iron pulleys for various purposes may be purchased on the market, there are instances in which special castings are required, in order that other details or mechanisms may be attached. Among the devices for which provision must be made on special pulley castings are mechanisms for starting and stopping, speed changing, lateral adjustment, connection to other driving elements, and special construction for use on certain types of spindles.

The standard cast-iron or steel pulley furnished by transmission equipment dealers is applicable chiefly to simple shafts and spindles for obtaining direct drives, or it may furnish the power to gear trains, although it is not suitable for many of the compact drives required in machine tool design. Standard cone pulleys are not generally available, except in designs suitable for a few simple main or feed drives. Generally, some special arrange-

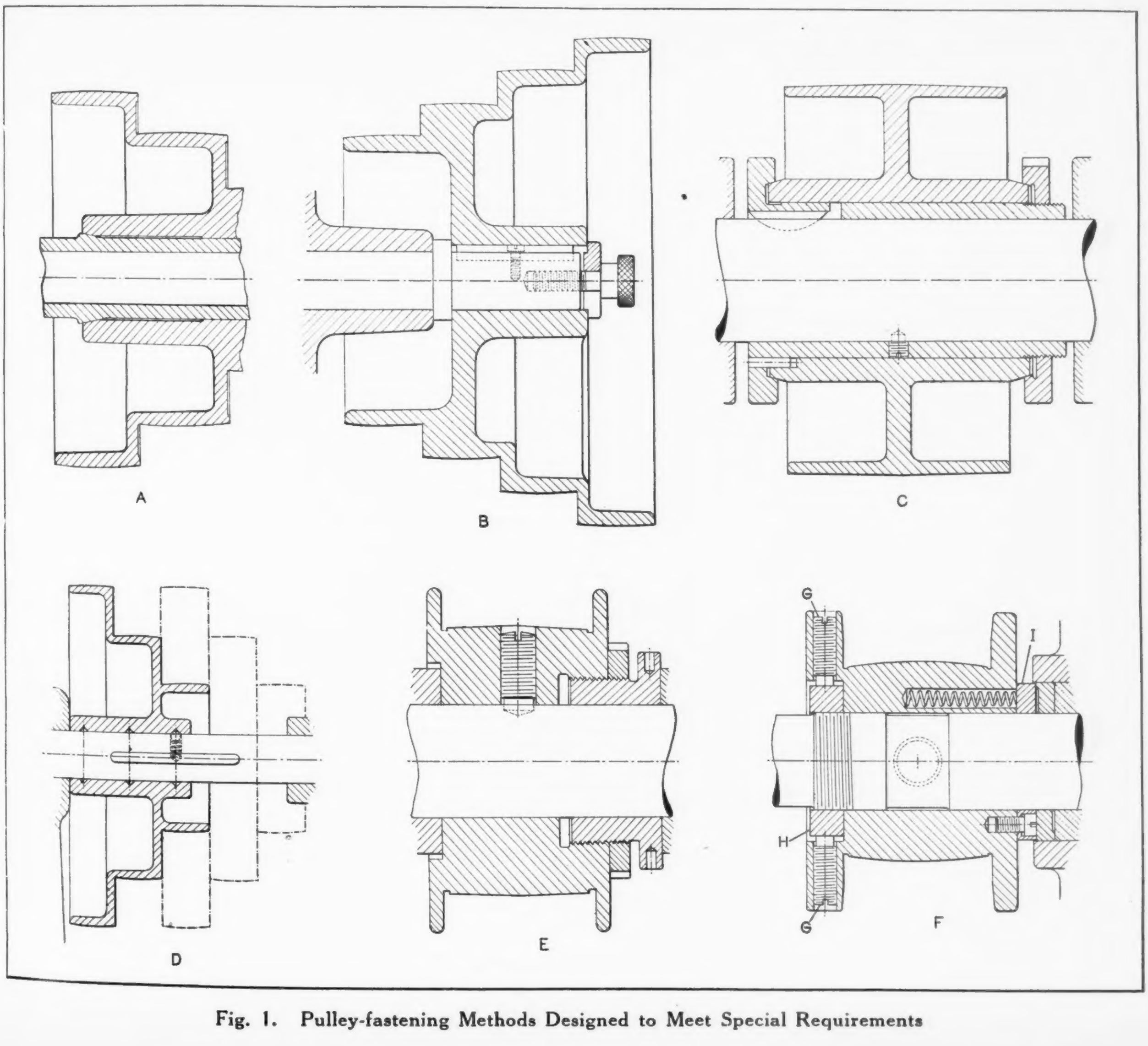


Fig. 1. Pulley-fastening Methods Designed to Meet Special Requirements

ment of clutches, gears, etc., in combination with the cones, necessitates the use of a specially designed casting.

Method of Securing Pulley to Shaft

The ordinary pulley is keyed or held in place by a set-screw. In some cases both a set-screw and a key may be required. One or two taper pins may also be employed in place of keys or set-screws, shaft by means of a nut at the end of the hub. In this design, the rotation of the spindle is obtained without the aid of a key or screw, thus avoiding the danger of destroying the hollow spindle. In some cases, a simple shrinkage fit of the pulley on the spindle is employed, using no other means of fastening.

Sometimes the pulley must be so designed that it can be easily and quickly removed. A pulley designed

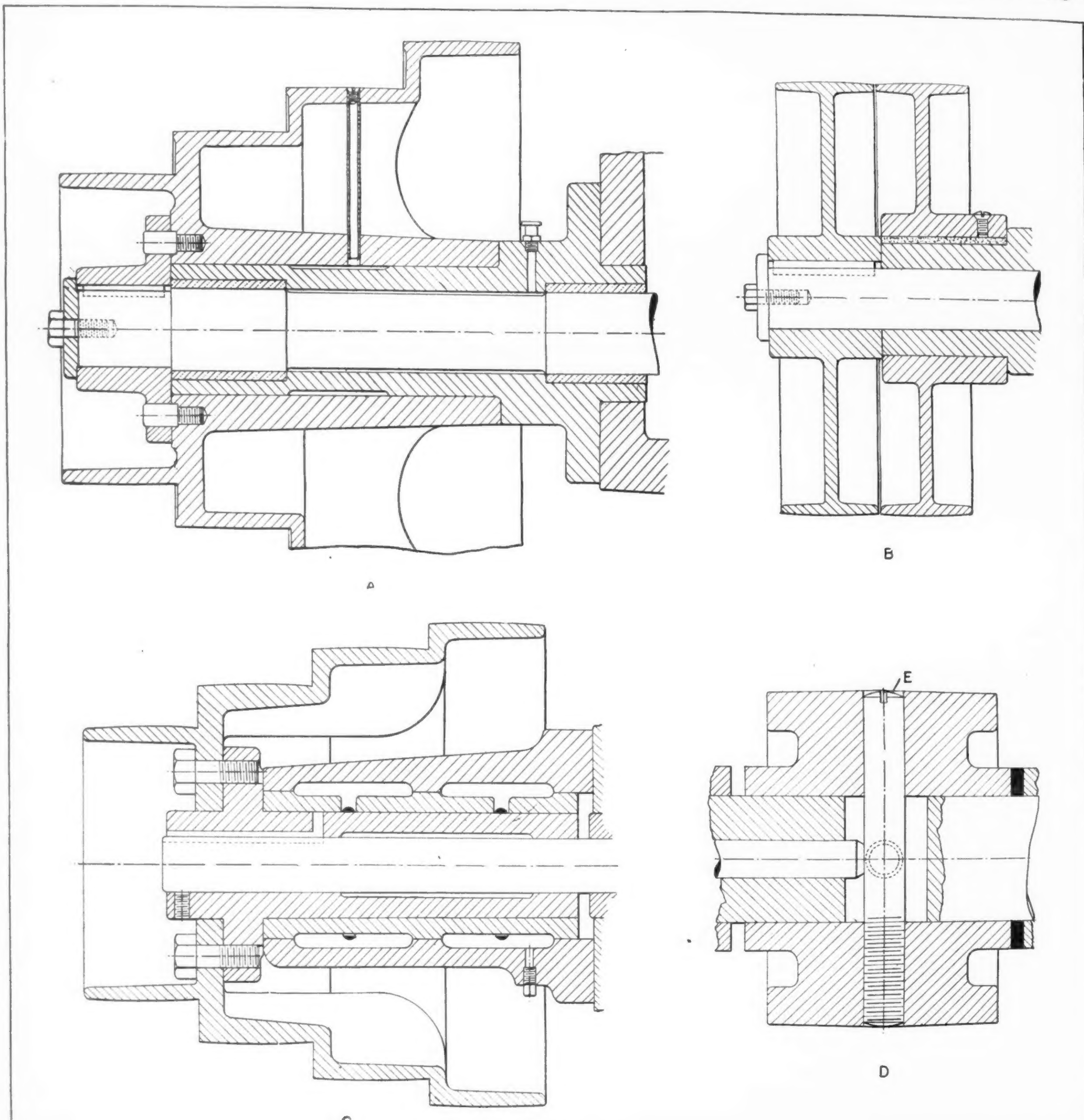


Fig. 2. Loose Pulleys with Stationary Bearings, and Pulley with Means for Obtaining Endwise Adjustment

particularly when end motion must be guarded against. The attachment of a pulley to thin hollow spindles presents a difficult problem on account of the danger of distortion. In such cases, a thin key is sometimes applied, or a screw with a cylindrical end which enters a hole in the spindle may be used. The latter design has the advantage that it exerts no radial pressure on the pulley or shaft. A good method of attaching a pulley to a tubular spindle is shown at *A*, Fig. 1. This method is similar in principle to the taper clutch drive, the pulley being forced or jammed on an angular surface on the to meet these requirements is shown at *B*. In this case, the pulley is secured by a fixed key and a slotted washer clamped in place by a knurled-head screw at the end of the shaft. A turn of the screw serves to release the slip washer, which can be removed to allow the pulley to be slipped off the shaft and its position reversed or a pulley of another size put in its place. The quick setting of a pulley to different positions along the shaft, as provided for in the design shown at *D*, is another desirable feature in certain cases. The countershaft shown in this view is used on a high-speed drilling machine,

where the pulley is driven by a key and locked by a ball catch in any one of three belt positions.

Split Pulley for Special Purpose

Split pulleys are not often required in machine tool construction, except in rare instances in which the changing of feed pulleys on enclosed portions of shafts is necessary, or in the case of one or two designs of grinding wheel spindles. At *C* is shown a type of split pulley employed on a plain grinder made by one manufacturer. The two halves of the pulley are held tightly together by a conical seat at one end and a nut at the other. This construction facilitates changing pulleys to obtain the desired peripheral speed for the wheel used. For larger pulleys, a split joint with a simple belt fastening, designed to clamp the halves to the shaft, may be used.

Pulleys Provided with Means for Obtaining Endwise Adjustment

Most pulleys are immovably secured on the shaft or spindle, but occasionally provision is made for endwise adjustment to take up wear. This feature is used chiefly when the pulley lies between bearings, as in the case of a tool grinder, as shown at *E*. Here a simple gland fitting with a lock-nut is used. On one belt grinding machine, the pulley is provided with the take-up shown at *F*. Adjustment of a collar at the right-hand end of the spindle for taking up wear is made by first loosening screws *G* slightly to release nut *H*. Next the belt is held stationary to prevent the pulley from turning, and the spindle revolved sufficiently to screw it through the nut *H* the slight amount necessary to take up the play at the end of collar *I*. The pulley is then locked in place by tightening the screws *G*.

The pulley adjustment, in the case of one style of cutter grinder, is obtained by the arrangement shown at *D*, Fig. 2. Here a cross-pin *E* is forced along by a take-up rod having an adjusting nut and lock-nut at the end of the spindle. The pulley is also locked by means of a screw, the end of which is shown by dotted lines.

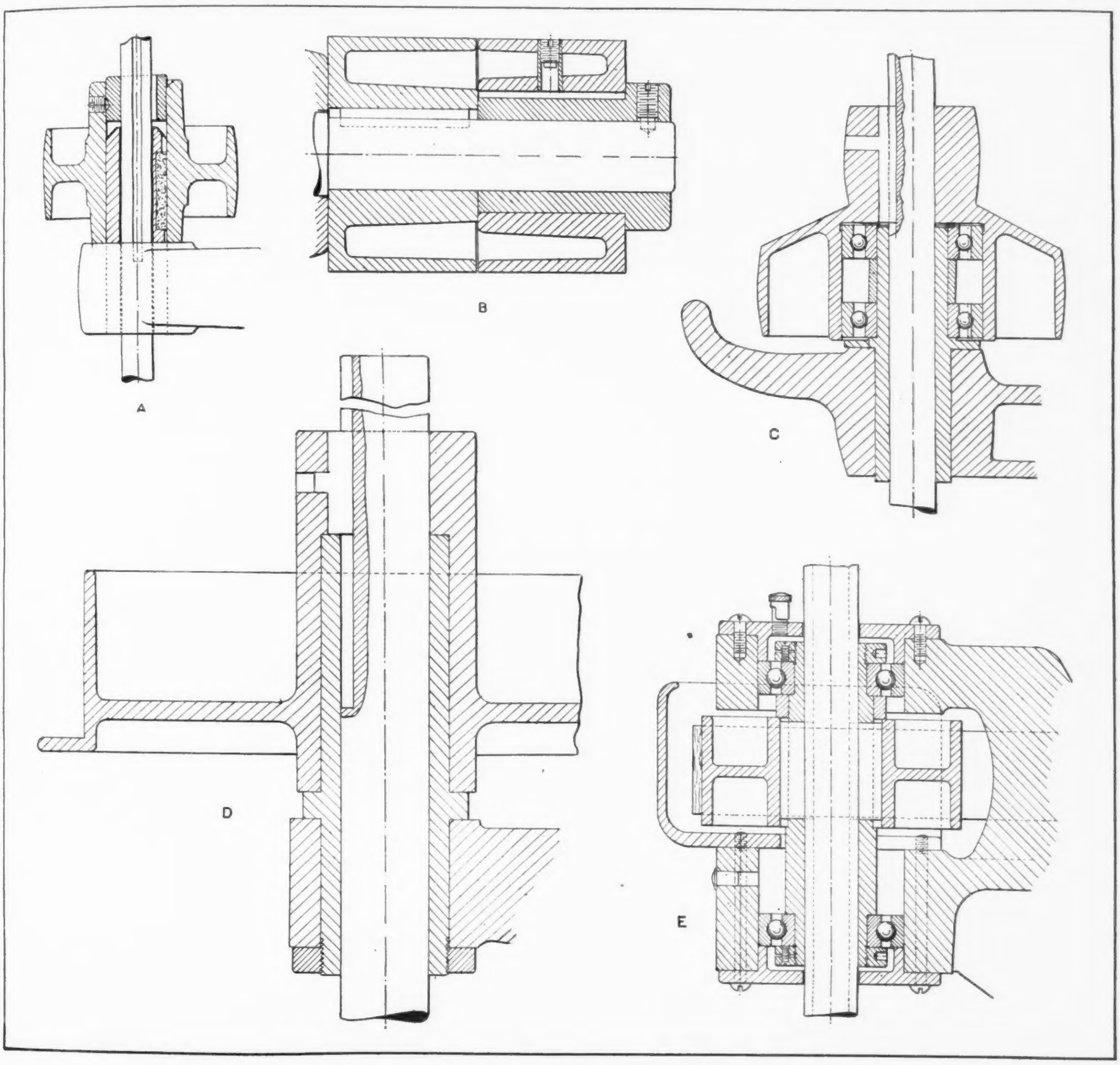


Fig. 3. Plain and Ball-bearing Pulleys for Vertical Shafts, and Horizontal-shaft Pulley Designed to Prevent Wear

Pulleys Designed to Relieve Spindle of Thrust

It is sometimes important that the spindle of a machine tool be relieved from side thrust, either because the pulley is exceptionally long, as in the case of cone pulleys, or because the spindle is required to slide up and down with a minimum amount of friction. The arrangement shown at *A*,

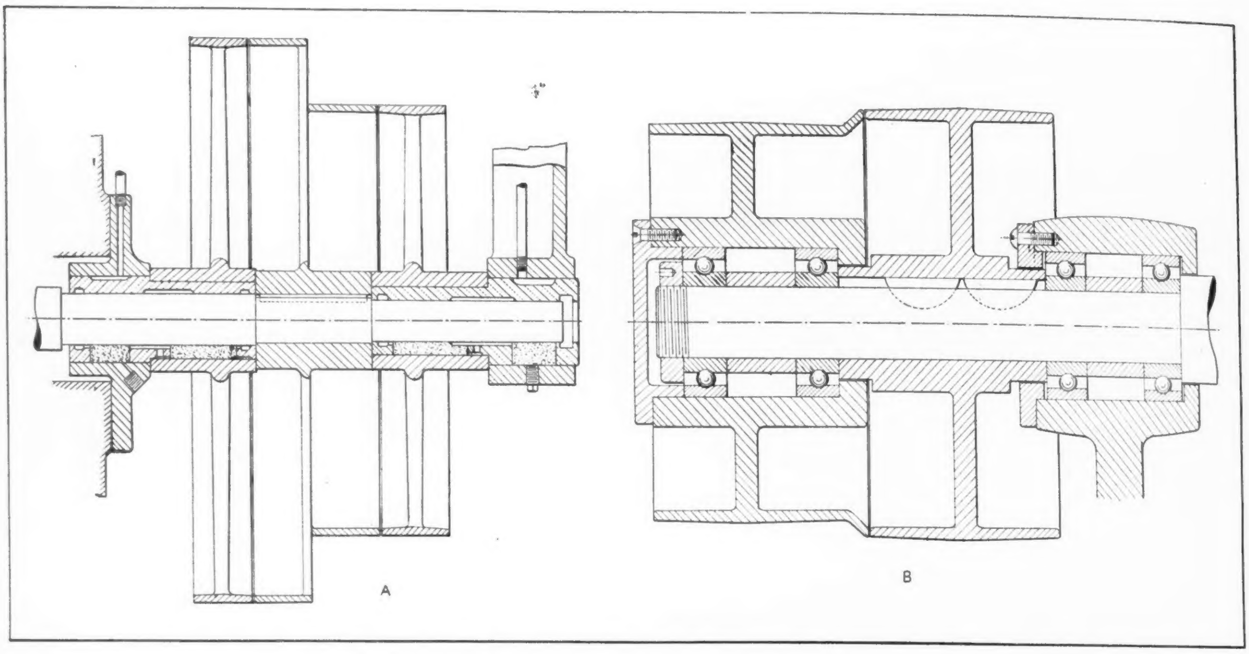


Fig. 4. Examples of Loose Pulleys with Plain and Ball Bearings

Fig. 2, is favored for designs in which the cone does not receive support from the shaft. With this design, the bore of the pulley runs on the fixed hub in which the shaft bearings are mounted. The shaft is driven by means of a coupling disk provided with driving pins, as shown. Another arrangement used on a shaper is shown at *C*. In this case, the pulley is bolted to the flange of a cast-iron sleeve running in a removable bushing provided with oil-rings.

Vertical drilling machines and vertical milling machines generally require some means for relieving the pulley from thrust. Formerly the thrust was taken by a bushing held in the vertical bearing, as shown at *A* and *D*, Fig. 3. The design shown at *A* was used on a sensitive drilling machine, and the one at *D* on a milling machine. Now ball bearings have superseded, to a considerable extent, the plain thrust bearings formerly employed. Some machine tool makers offer the choice of ball bearings or plain thrust bearings, the plain bearings being somewhat lower in price.

At *C* is shown a modern type of mounting, with the spindle passing freely through the sleeve but centralized by the upper part of the pulley. Either one or two driving keys are generally used, although multiple splines are now coming into favor. The advantage of the multiple spline is that it causes less wear on the spindle. Consequently, uneven fitting of the spindle in the sleeve, due to operating the spindle continuously in one position, is less troublesome. It will be noted that the pulley has a conical surface which separates the steps. This gives a nice lead-off to the belt instead of allowing it to cut across the sharp corner of the large step. A still later arrangement, developed for high-speed drills, is shown at *E*. In this design, the pulley is located between two bearings, the sleeve being supported by two ball races.

Bearing Arrangements for Loose Pulleys

The prevention of actual contact between the loose pulley and the shaft is desirable, for the reason that it avoids wear on the shaft and eliminates excessive overhang of one of the pulleys beyond the end of the bearing. These disadvantages are avoided in the designs illustrated at *B*, Fig. 3, and at *B*, Fig. 2. The construction at *B*, Fig. 3, is used on a single-wheel tool grinder spindle. In this case, the pulley rotates on the bushing secured to the shaft. Reduced overhang, combined with elimination of shaft wear, is obtained by utilizing the drive shown at *B*, Fig. 2.

Excessive speed between loose pulleys and the

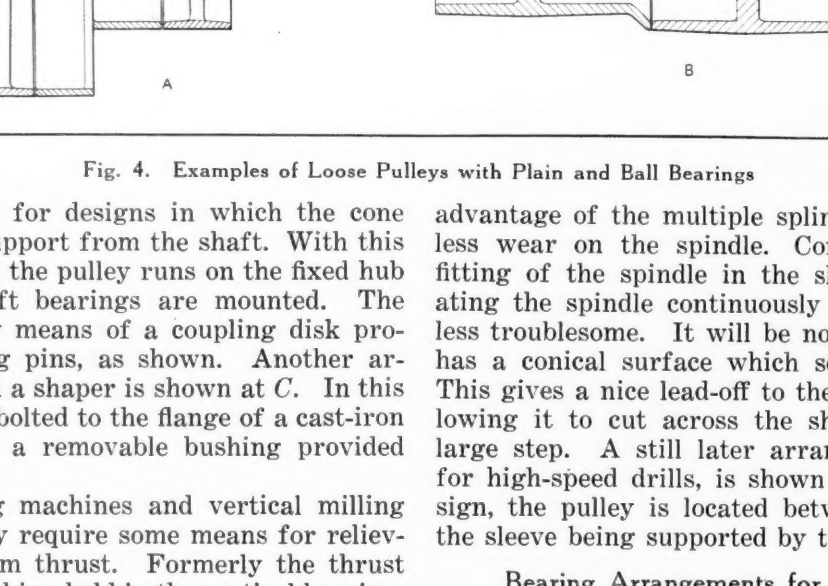


Fig. 5. Balanced Drum and Simple Ball-bearing Idler Pulley

shaft, when the pulleys revolve in opposite directions, as in the case of the planer reversing pulleys shown at *A*, Fig. 4, is another good reason for providing a stationary bearing for the loose pulley. Thus, the pulleys shown in this view are arranged to run on stationary bronze bearings, the shaft turning within the bearings, with tight aluminum pulleys running between the loose pulleys. Loose pulleys equipped with ball bearings consume less power and eliminate much of the trouble previously experienced in maintaining proper lubrication. A good example of a ball-bearing equipped loose pulley and countershaft is shown at *B*.

Long cylinders or drums such as shown at *A*, Fig. 5, are necessarily fitted to the shaft by means of hubs located at each end, whether or not the pulley is cast in one piece, as in the case of long taper pulleys used for variable-speed drives, or is built up with separate ends and a body. It will be noted that the drum shown at *A*, which is used on a grinding machine, has annular grooves for the adjustment of the balance weights. Many of the idler pulleys are merely cast tubes set on ball bearings. A typical vertical design of this nature is shown at *B*. Another article, dealing mainly with clutch pulleys, will be published in an early number.

* * *

AUTOMOBILE BUILDING IN FRANCE AND GERMANY

In a review of industrial conditions in France and Germany, by R. B. Luchars, vice-president of The Industrial Press, publishers of MACHINERY, it is mentioned that the output of automobiles in France rose from 55,000 in 1921 to 190,000 in 1926. During the past year, however, this rate of production was not maintained. According to the latest estimates, the 1927 figures will be approximately 30 per cent below that for 1926. The largest producer is Citroen, building 200 cars a day and employing 28,000 men. All of these, however, are not employed on automobiles, as a considerable number are engaged in making tools and unit parts, such as ball bearings, which are produced at the rate of 5000 a day. The output of other leading builders is given as follows: Peugeot, 150 per day; Renault, 125 per day; Berliet, 100 per day; Mathis, 50 per day; and Chenard & Walcker, 30 per day. At the Renault factory about 15,000 men are employed on automobile work.

In Germany, the production figures given are as follows: Opel, the outstanding leader in the automobile field, turns out about 200 cars a day. Brennabor and Daimler come next in order of importance, the former building about 50 and the latter about 20 cars per day. Adler is credited with 30 cars per day, and Hanomag with about 30 per day. The Wanderer car is built at the rate of about 20 per day.

Systematic Machine Repairing

The problem of maintenance presents many difficulties in the average shop. The larger the shop, the greater these difficulties become; and in big plants it is necessary to organize a special department to take care of maintenance and machine repairs throughout the shop. The leading article in April MACHINERY will describe how the machine repair department of the Westinghouse Electric & Mfg. Co. at East Pittsburg, Pa., is organized and operated. In this department, 200 men are employed in machine repairing, in addition to 50 men engaged in building special machine tools and in equipping machines with motor drives. The article contains many valuable suggestions that will be useful to both large and small shops.

NEW ENGINEERING INDEX SERVICE

A new engineering weekly card index service has been made available to the industries through the American Society of Mechanical Engineers, 29 W. 39th St., New York City. The United Engineering Societies Library in New York City, the largest strictly technical library in the world, receives regularly over 1700 technical publications published in thirty-seven different countries and in seventeen different languages. These publications are all reviewed by a competent staff, and all important articles are indexed on cards of standard library size, these cards being printed and distributed weekly to subscribers for this card index service. The object is to keep libraries, research departments, manufacturers, consulting engineers, and others interested in a complete review of the important articles published in the engineering press, informed through an up-to-date index.

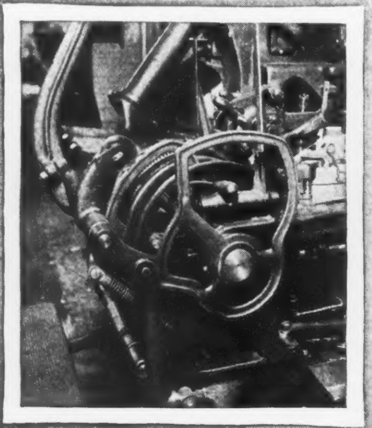
The engineering field has been divided into thirteen different classifications. Subscribers for the service may either subscribe for all the classifications or for one or more. Each classification is, in turn, subdivided into several sub-classifications, and a subscriber may obtain the index cards for one sub-classification only, should he so desire. The mechanical engineering field, for example, is subdivided into seventeen sub-classifications.

The service is conducted on a non-profit-making basis, and is made as flexible as consistent with the cost of production, that is, the reviewing, digesting, editing, publishing, classifying, sorting, and mailing. The American Society of Mechanical Engineers has undertaken this work solely because no index service of this kind is available in the world, and the growth and importance of engineering and its many ramifications seem to call for an organization that can handle an undertaking of this kind.

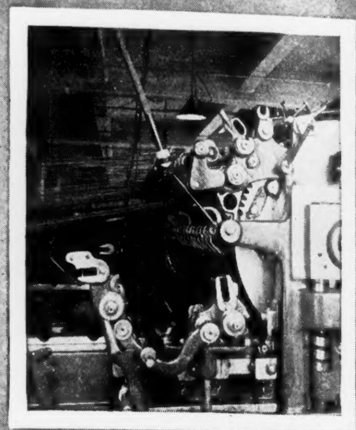
* * *

TESTS ON WELDED ROOF TRUSSES

The General Electric Co., Schenectady, N. Y., announces that tests on electric arc-welded roof trusses were recently conducted at the plant of the American Bridge Co. at Trenton, N. J. A live load double that for which the truss was designed was placed on the truss with satisfactory results. A general plan for welded roof trusses was prepared by William Dalton of the General Electric Co., from which a number of trusses of varying lengths and different loads were designed and built by the American Bridge Co. for the tests. It is claimed that a welded truss can be built with less metal and at less expense than the riveted type for the same load and span. However, actual figures giving comparative expense have not yet been published.



Ingenious Mechanical Movements



FRICTION-RATCHET FEED MECHANISM

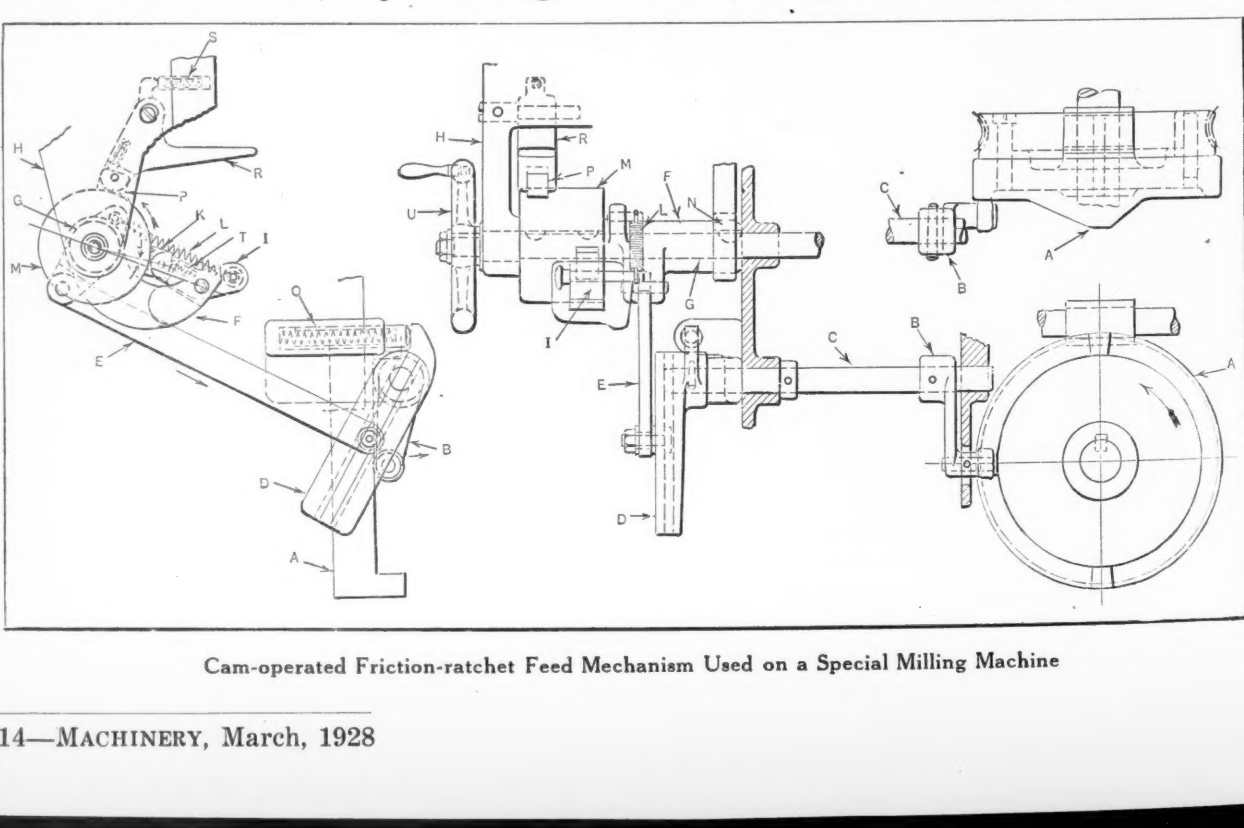
By FRED ADAMS

The friction-ratchet feeding mechanism to be described is used on a special milling machine equipped with end milling cutters which pass to and fro across the work, necessitating an in feed at the end of each stroke. This feed varies in depth according to the diameter of the cutter and the kind of material being milled, and the feeding mechanism may be adjusted to vary the feed from 0 to 1/32 inch per cutter revolution.

The feeding motion is derived from a cam *A* having two lobes located 180 degrees apart. This cam is rotated in the direction of the arrow by worm-gearing, and through roll lever *B* and shaft *C*, transmits a swinging movement to the adjustable feed-lever *D*, which has a T-slot extending the entire length. The radial position of a T-bolt connecting lever *D* with link *E* controls the extent to which the friction-ratchet lever *F* turns about shaft *G*, upon which it is free to rotate. The serrated friction-ratchet shoe *K* is pivoted to lever *I*, which, in turn, is pivoted on an eccentric stud for varying the angle *J* between the center lines and obtaining a toggle action which insures a firm grip between shoe *K* and drum *M*. Spring *L*, which is fastened to levers *F* and *I*, keeps shoe *K* against feed-drum *M*. This drum is keyed to shaft *G* which, through pinion *N* and a train of gearing (not shown) transmits the feeding movement to the spindle feed-screw. The cylindrical surface of the cast-iron drum *M* is ground and polished, and the hardened steel shoe *K* is also ground and the face lapped, as well as serrated or notched to obtain a better grip.

If shoe *K* slips, the eccentric stud of lever *I* is loosened and turned a slight amount to reduce the angle *J* (indicated by the arrows), thus increasing the grip between shoe *K* and drum *M*. This adjustment should not, of course, be great enough to reduce angle *J* to zero. If shoe *K* binds, this means that angle *J* should be increased.

During the return stroke, spring plunger *O* which bears against the extension on feed-lever *D*, turns the lever in the opposite direction and keeps the cam roller in contact with cam *A*. The brake-shoe *P*, which operates with a toggle action, safeguards against a reversal of drum *M* due to frictional resistance when shoe *K* is returning. The brake-shoe lever *R*, like lever *I*, is pivoted on an eccentric stud for varying the toggle angle, and the brake is held in position by spring plunger *S*. These eccentric studs may be clamped after adjustment by a small screw and brass shoe.



Cam-operated Friction-ratchet Feed Mechanism Used on a Special Milling Machine

When the milling cutters have reached the desired depth and are to be withdrawn, the operator pulls toggle I down over the center, which releases shoe K. Spring plunger T holds this shoe in such a position that it will engage properly when the toggle is snapped back into the feeding position. Downward pressure on brake lever R will allow handwheel U to be rotated in an opposite direction to that employed for feeding.

This design of feeding mechanism has been used successfully in several installations. It is flexible so far as adjustments are concerned, and if the feed-drum M is coated with a film of oil, no perceptible wear can be seen after a long period of use.

* * *

REVERSING VARIABLE-SPEED MECHANISM

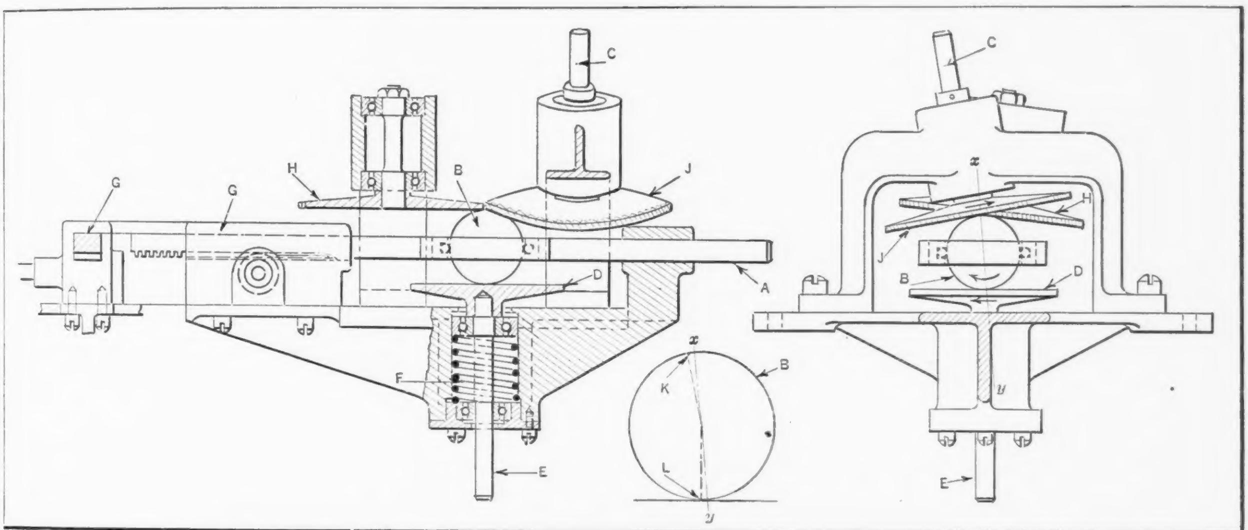
By M. F. BATES

The effective use of anti-aircraft guns at long range and against such a rapidly moving target as an airplane requires special devices to assist in setting the gun sights vertically and laterally, and also for timing the fuse which controls the bursting of the high-explosive shell. In training the sights upon an airplane, two small telescopes are used. One operator, by means of a handwheel, keeps the target on a vertical line in one telescope, and another operator, also by handwheel regulation, keeps the target on a horizontal line in the second telescope. The turning of these handwheels registers angular rates of change in the instrument, which is the basis for predicting the future position of the airplane within the time required for the projectile to reach it. It is at this point that the reversing variable-speed drive to be described finds one of its applications.

The position of shaft A and ball B with its retainer is a function of the speed and indicative of the direction of rotation of shaft C when disk D is rotated at a known constant speed. An important requirement is that shaft A and the ball retainer should slide freely for all speed changes, and to meet this requirement, ball B must be in rolling contact with the disks.

The illustration shows at the left a partial side view and cross-section, and at the right an end view with part of the base casting cut away. The driving disk D is attached to shaft E, which is mounted in ball bearings. An upward thrust of about 5 pounds is applied to disk D by spring F located between the ball bearings. To permit this thrust, shaft E is free to slide in the inner race of the lower ball bearing, while the outer race of the upper bearing is free to slide in the bore of the base casting. The retainer for ball B has a square-grooved ball race containing twenty-eight 1/8-inch balls, which are held in place by the 1-inch ball B. Shaft A has a square guide bearing G. Rack teeth on the lower face of the square end engage a pinion for traversing shaft A and ball B, the ball being in the mid position, as shown in the illustration.

The driven disks H and J are equipped with ball bearings and supported by suitable brackets. The shafts of these disks incline 10 degrees from the vertical, so that disks H and J incline the same amount in opposite directions relative to the driving disk D (see end view). To make the illustration clearer, the cross-section of disk H (left-hand view) is shown in the vertical plane. Disks H and J have small skew gear teeth cut in their edges so that when ball B is under disk H, the driven shaft C is reversed through this skew gear drive.

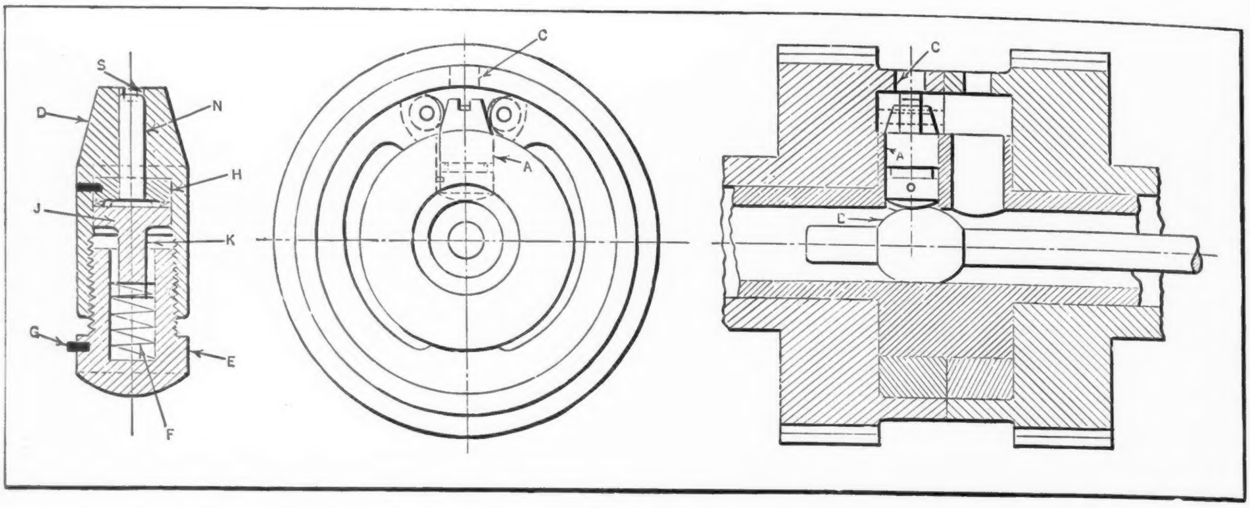


Reversing Variable-speed Drive which is Part o. Gun-fire Control Apparatus

If ball B is in contact with disk J, the parts will revolve in the direction shown by the arrows (see end view). Ball B might be said to roll up hill with respect to disk J, the reaction of the ball when transmitting torque being on the left side of its retainer, as seen in this end view. The points of contact between the ball and disks J and D are at K and L (see enlarged detail view). When the retainer and ball are shifted, the ball spins about axis x–y and the contact points K and L generate small polar circles; this is the secret of the easy ball shift obtained with this design.

When the ball is in the central or zero position and shaft C is stationary, the ball has three contact points. One, of course, is on disk D, and the other two, which are very close together, are on disks H and J. This is the position shown by the left-hand illustration.

In operating the device in which this mechanism forms a part, shaft E is closely regulated to run at 300 revolutions per minute, and the torque required



Compact Design of Friction Clutch Adjustment which Locks Automatically

at C is approximately 5 ounce-inches. This mechanism is only intended for comparatively light drives of the nature described.

* * *

FRICTION CLUTCH ADJUSTMENT

By ALBERT CLEGG

The adjusting plunger used for some types of friction clutches is interesting, not so much because of any wonderful mechanical complication, but rather because of its simplicity and effectiveness. The clutches on which this device are used are of the expanding ring type, in which a conical plunger A (see illustration) is moved outward by a rod B, thus forcing the friction ring against the inside of the driving gear or pulley. The only place for adjustment is the hole at C in the driving gear, and to allow for wear on the friction surfaces, the plunger A must be capable of being lengthened. Such provision is made in the plunger itself, including means for insuring that the new adjustment will "stay put."

The part D (see enlarged sectional view) having the tapered end is bored and tapped, and has, secured to it by a pin, a washer H, on the inner face of which are fine-pitch clutch teeth. Engaging with these are the teeth on piece J which, on the end opposite to the teeth, is milled to form a tongue K. This tongue engages a deep groove cut transversely in the threaded end of E. The latter is bored to receive a spring F which, pressing against the end of tongue K, keeps the clutch piece J in engagement with the teeth of H. On the head of E is a small pin G which fits into a groove in the plunger bearing and prevents E from turning. In the conical end is a screwdriver slot S, and in the center of this slot is a pin N. The head of pin N bears against clutch J, and the outer end projects slightly above the bottom of the slot.

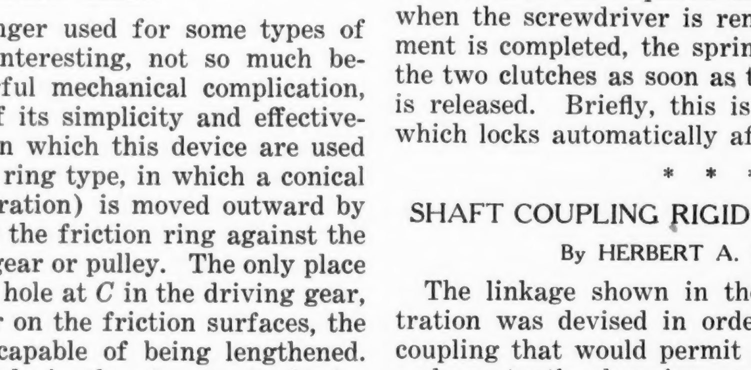
Assuming that the clutch is assembled and requires to be adjusted, the driving pulley is first turned until the screwdriver slot comes opposite the hole C. Then a screwdriver is inserted and pressed lightly to move plunger N, which disconnects clutches J and H, after which the plunger is turned until the required adjustment is obtained, when the screwdriver is removed and the adjustment is completed, the spring F again connecting the two clutches as soon as the end pressure on N is released. Briefly, this is a lengthening device which locks automatically after every adjustment.

* * *

SHAFT COUPLING RIGID IN TORSION ONLY

By HERBERT A. FREEMAN

The linkage shown in the accompanying illustration was devised in order to secure a flexible coupling that would permit a comparatively large and constantly changing amount of misalignment. With this arrangement, misalignment does not cause the coupling to heat or become noisy. Mounted on the driven member so they can rotate are two bellcranks B, which are joined by a link D as shown, so that they rock in unison. These bellcranks are also connected with the driving spider A by links C, which should be provided with ball brasses if the angular misalignment is excessive. A line diagram of the linkage is shown at the right in the illustration. The broken lines indicate the position taken by the links and the bellcranks when vertical displacement takes place.



Shaft Coupling Designed for Lateral or Angular Displacement

* * *

The fourth machine tool and engineering exhibition of the British machine tool builders will be held at Olympia, London, September 5 to 22 this year. The exhibition promises to be unusually extensive, as all the main hall and nearly the entire annex have already been engaged for exhibits.

What MACHINERY'S Readers Think

Brief Contributions of General Interest are Solicited and Paid for

SAFEGUARDING APPRENTICES AGAINST ACCIDENTS

A survey of many years' experience in machine shops discloses the fact that most accidents, per number of men employed, happen to apprentices, which is primarily due rather to their ignorance of the dangers in the shop than to carelessness. An effective means of informing apprentices about dangerous practices in the shop, and of impressing them so that they will be more careful, is to have someone relate true and detailed accounts of serious accidents that have actually happened in the shop in which they work or in a nearby shop.

The writer recently noted the good effects of this procedure. A fatal accident happened in another shop, because a boy had been riding on the planer table. All the gruesome details in connection with the accident were faithfully recounted to the boys who were gathered together at a noon period. Strict orders not to ride on planer tables had not been able to prevent this practice, but the account of the accident so impressed the boys that it solved the planer riding habit entirely in this shop. Dangerous practices of many kinds can be effectively combatted in this way.

RAYMOND H. DAUTERICH

SUPPLY TECHNICAL JOURNALS TO THE ENGINEERING DEPARTMENT

Manufacturers who spend thousands of dollars a year advertising their product to the trade are often reluctant to spend a few dollars for subscriptions to leading trade journals which would acquaint their foremen and engineering departments with the systems and methods in effect in the plants of other manufacturers. The value of the technical magazine as a medium for keeping a mechanical man well posted on modern methods cannot be overestimated.

The tremendous amount of data, tried-out-and-found-satisfactory systems and money-saving kinks that are published each year make the reader of these journals worth more to the company he works for. The adoption by the shop of but a single method described in the pages of MACHINERY may repay the management a hundredfold for furnishing its engineering department with a copy of the magazine. I do not advocate converting the factory into a library, but the management that aids its workers in acquiring new ideas is aiding itself to increase production, reduce costs, and obtain greater profits.

SAMUEL KAUFFMAN

CHAIRS FOR WORKMEN

Apparently, there is a difference of opinion among manufacturers as to the value of chairs or stools in shop work. The writer has had considerable experience in shops where stools are provided for every mechanic, as well as in plants doing precisely the same kind of work, where sitting is not permitted. Effective results can often be obtained when the workers are provided with suitable stools. In fact, certain tasks are more likely to be handled methodically and at the same time with greater rapidity, if the worker can assume a comfortable position.

It is simply a matter of judgment on the part of the management as to when to furnish stools and when not to permit their use. There need be no arbitrary rules governing the use of stools or chairs—utility and service should be the determining factors.

In industrial work, good posture is not assured by merely having a good stool or chair; the worker, the stool, or chair, the bench and the material should be correlated properly. It should not be necessary for the worker to sit on the edge of a stool or chair in order to reach a foot-pedal, nor change his position in the chair in order to reach material. The stool or chair should be adjustable for height, and the back-rest should be adjusted to fit the small of the worker's back.

A. EYLES

TECHNICAL REPORTS—WRITTEN AND ORAL

I agree with Mr. Gordon-Sale in his conclusions favoring oral reports, as stated on page 283 of December MACHINERY. However, there is an even more important reason for avoiding written reports; if the system is persisted in, all sight is lost of the initial objective—the correction of a difficulty—and the emphasis gradually is placed on a secondary consideration—the placing of responsibility.

Usually those whose duty it becomes to investigate such matters under a written report system are so busy fixing the responsibility for past difficulties that they have neither the time nor the in-

Have You Any Suggestions to Offer?

The pages "What MACHINERY's Readers Think" are an open forum. Opinions on subjects of general interest to men engaged in the machine-building and metal-working industries are invited.

This month, two of MACHINERY's readers deal with safety in the shop. One points out that guards can be more dangerous if not properly designed than if no guards at all were used. We all recognize that on old machines it is difficult to install really satisfactory guards. What is to be done?

Another reader brings up the question as to whether stools or chairs should be provided when the work is of such a nature that it can be performed sitting down. This is not an unimportant question, for it is recognized that a tired man does not produce as good work as one who is rested.

clination to suggest means for preventing similar troubles in the future. All initiative in that direction is submerged in the details covering the reasons for past deficiencies, to no really useful purpose.

The foremen gradually succumb to this condition and lapse into a mental state in which they rest complacently as long as they feel that their alibi is complete. Thus the written report creates a condition that gradually destroys the very structure it is supposed to build up.

The oral report system inspires cooperation and creates a better and broader understanding of the fundamental object to be attained, which, after all, is the satisfactory and prompt filling of orders at a profit. The foremen speak more freely when they know that what they say is not to be quoted in a written report, and will do their utmost to assist in ironing out difficulties and absorbing delays occurring in another department, because it is just a matter between Bill and Jack and themselves. The oral report system is one of direct dealing. It avoids the artificialities of the written report and should be encouraged. MORTON SCHWAM

REFERENCES FROM PAST EMPLOYERS

The practice of many shops in requiring references from an applicant for employment sometimes works a hardship on a man who may find it necessary to refer to his last employer, because in some cases, employers harbor grudges against men who leave of their own accord to seek positions giving them greater opportunities or better working conditions.

A friend of mine recently left his job with a large public utility corporation because it was required of him to report for work daily at a place fifteen miles from his home at a very inconvenient hour. The man preferred to give up his job rather than to work under these conditions. The superintendent who had assigned him to the work, however, became very angry, and warned him that he would prevent him from getting another job in any important shop in the city.

This attitude is very short-sighted, but fortunately, this is an extreme case. However, it behooves every employment manager to weigh carefully the reasons offered by an applicant as to why he may not be able to obtain a satisfactory reference from his previous employer. There are two sides to every question. SAM WRIGHT

SAFETY GUARDS MUST BE SAFE

The writer has seen and heard much about workmen's opposition to guards on machines and knows that operators often remove the guards, although by doing so they are laying themselves open to reprimands. The reason is simple. The guards either hinder the operator in his work so that he cannot earn a day's pay or else they may be so constructed that they are more dangerous than the machine without the guard.

The last statement does not apply to the new machines now on the market, because machine tool builders at present are producing well guarded machines, but it applies to machines built years ago which in many cases were not originally provided with guards and later were fitted with unsatisfactory makeshift contraptions. The writer himself has only been injured once in twenty years of shop employment, and this injury was due to a poorly designed guard.

Well designed guards are a necessity, but they should offer absolute protection; otherwise they may be more dangerous than no guards at all, because they make the workman feel secure when he is not. Guards placed on old machines are often made of perforated sheet steel with many edges extending outward or inward. A familiar instance of this is the old-style drill press guard consisting of a cage of perforated metal built around the belt and the pulleys. On such a machine a gate or door is necessary for shifting the belt. The sharp side of the perforated guard is usually turned in, and when the operator opens the door to shift the belt, he often has the skin removed from his knuckles.

On the old-style tool grinder no adjustment is provided for the guard, and when the wheel wears, the guard is much too far away from it. The work may easily get in between the wheel and the guard, thus seriously injuring the workman's fingers.

The question of providing safety guards that are safe on old machines is one that will be with us for some time to come. JOHN J. KAUFFMAN

CHANGE THE DRAWING BUT SAVE RECORD OF THE ORIGINAL

Jack Brown and Bill Smith, fellow chief draftsmen, were having one of their usual weekly lunches together at which they discussed their various problems. Jack was relating an experience of the morning with a new contract for a complete plant installation which called for exactly the same layout and equipment as that originally designed for the Acme Co.'s job. Owing to a fortunate purchase of tanks and miscellaneous equipment, however, the design and drawings of the Acme job had been modified to utilize this newly acquired material. A Vandyke print made from the drawing would, of course, have been as good as the original tracing for producing the blueprints, but although Vandyke copies had been made in some cases before changing the drawing or tracing, no one had thought of taking such precautions in this particular case.

Now here was Brown faced with the problem of being obliged to make a whole set of plans. "Well," said Bill, "we found ourselves in the same fix some time ago. It's always the job on which you really want the Vandyke prints that no one has thought to have them made before changing the drawings. For this reason, we have adopted the fixed rule that no plan is to be taken from the file for changes without first having a Vandyke made. This means that Vandyke prints are provided for every job, perhaps unnecessarily in the majority of cases, but the cost over a period of time is far less than the loss would be in cases where they are actually needed. With this system in use, the drawings for a new job may be changed in any of their details without affecting the completeness of the original records of existing or standing installations.

JOHN F. HARDECKER

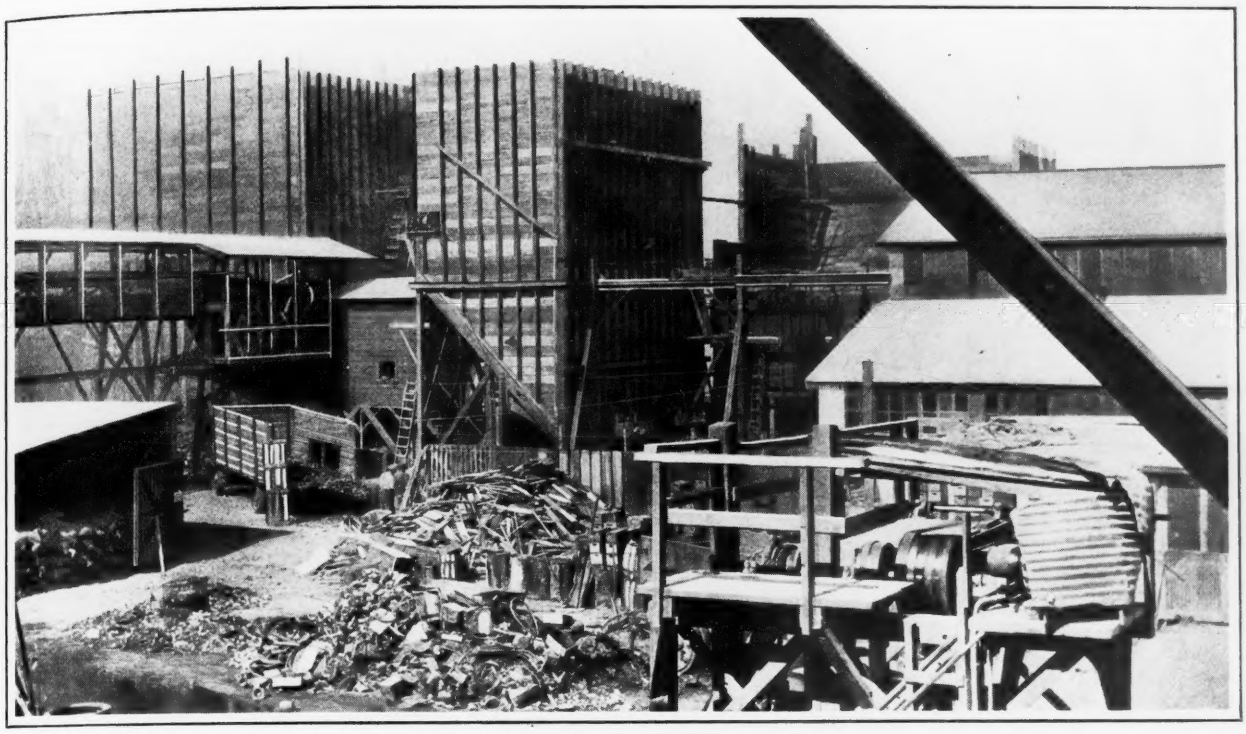


Fig. 1. Tin Reclamation Plant of the Metals Refining Co., in Los Angeles

Salvaging Tin Cans

By LEE McCRAE

AT last tin can alley is to be cleaned up! After two years' experimentation, a $275,000 plant, (see Fig. 1) erected by the Metals Refining Co. of Los Angeles, Cal., is salvaging from 1200 to 1500 tons of empty tin cans each month. A process of reclamation has been worked out by which the tin and steel in tin cans may be worked over and over again. It is so new that special machinery had to be made, and little by little, the process has been improved until now, with unfinished facilities and with workers that are new in the industry, an average of three tons a week of pure tin is obtained. This tin is molded into 55-pound ingots and shipped to factories where it comes out as shiny new cans to hold the next fruit crop. Besides this, from 60 to 65 tons of highest grade steel are salvaged daily. A ton of old "empties" yields about 18 pounds of tin.

Huge trucks bring in the "empties," which are dumped into a great pit, whence they are conveyed on an endless belt, as shown in Fig. 4, to a storage bin. While on the conveyor belt, all burnt cans, galvanized ware, and glass are eliminated by sorting. The difficult task of getting off the labels is performed by running the tins through a mangle and shredding machine, which removes most of them. From this, they are passed down a long chute, where the loose scraps are drawn off by suction as the crushed tins go on through an incinerator into a chute of churning water, which

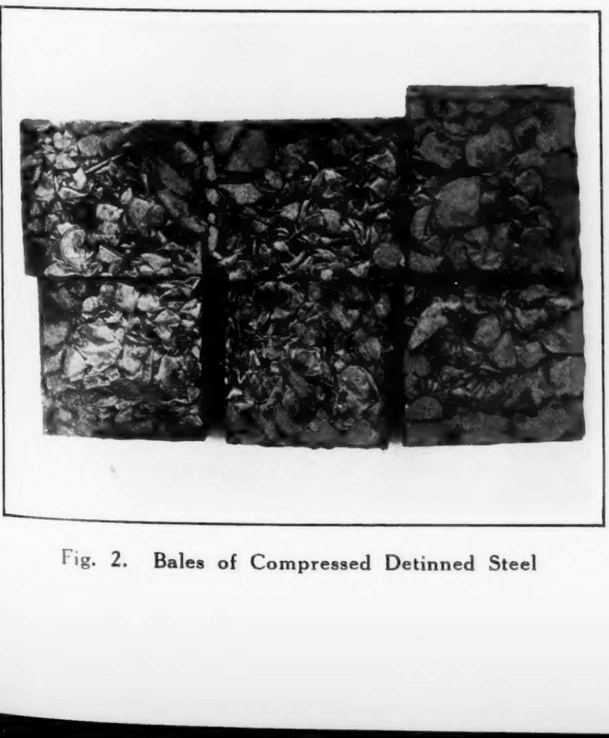


Fig. 2. Bales of Compressed Detinned Steel

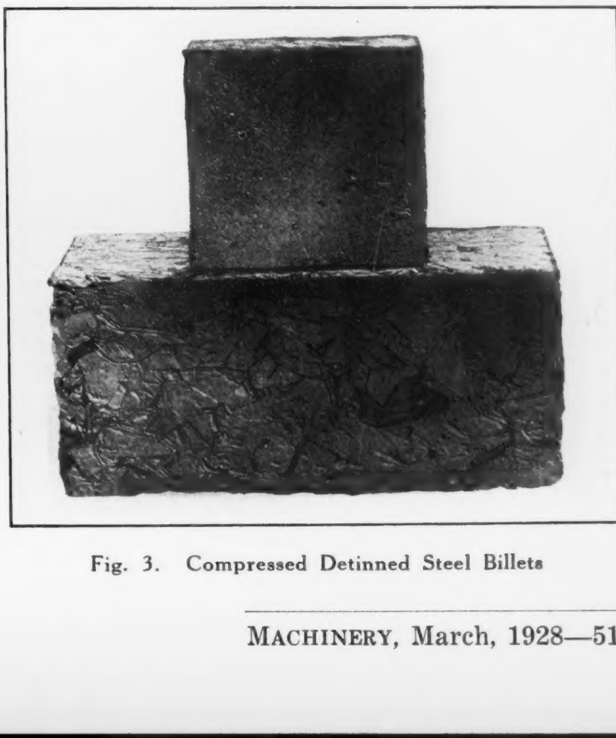


Fig. 3. Compressed Detinned Steel Billets

Fig. 4. Conveyor Belt on which "Empties" are Sorted and Carried to a Storage Bin

effectually washes them and chemically destroys all grease and other foreign substances.

After this cleansing, they pass into steel baskets, resembling huge French frying pans, and are immersed in a vat containing a strong caustic solution, which separates the tin by chemical action. The detinning takes about one hour. Only the steel remains, and this drops automatically on a hydraulic baler, Fig. 5, which is capable of developing a pressure of 7000 pounds per square inch. The baler presses the steel into bales 14 by 14 by 14 inches, as shown in Fig. 2. The steel thus salvaged is particularly useful for the precipitation of copper, and is so used in the copper refineries of Mexico. Fig. 3 shows hydraulically pressed detinned steel scrap put up in billets 18 by 8 by 8 inches to be sent to steel mills for open-hearth melting.

Fig. 5. Hydraulic Baler for Pressing Salvaged Steel into Bales

The caustic solution employed in the detinning operation diminishes in strength as it is used, but its strength is restored by a process of evaporation with the addition of water. The gases arising as a dust and vapor are drawn into immense bags, kept at a moderate degree of heat. This dust is 40 per cent pure tin.

The last step is casting the tin into bars or ingots ready for shipment, as illustrated in Fig. 6. The "pig tin," as it is called, weighs about 55 pounds. It is sold through metal brokers to be used ultimately for bronze castings, babbitt, solder, etc.

This process, besides being valuable in conserving needed metals, has the added worthwhile feature of clearing the city dumps of unsightly junk.

* * *

The average freight rate per ton-mile of the railways of the United States is now only 14 per cent greater than in 1890, the increase per ton-mile being from 0.941 to 1.069 cents. Meanwhile the wholesale price of all commodities has increased on an average 79 per cent.

THE GERMAN MACHINE TOOL INDUSTRY

According to a report prepared by Trade Commissioner Theodore Pilger and published by the Department of Commerce, there are in Germany between 800 and 900 factories devoted to the manufacture of metal-working machinery. In Berlin and its immediate surroundings alone, there are 85 metal-working machinery building plants. These shops employ approximately 65,000 men. The United States industrial census for 1925 shows that there were then in this country 378 metal-working machinery plants, employing a total of approximately 45,000 men. It should be noted, however, that German production was estimated at $1000 per workman per year, whereas American production per workman was $4800 per year.

The exports in 1927 exceeded those in 1926. Although the export tonnage of pre-war years has not yet been reached, the value has already greatly exceeded pre-war exports, and in that respect 1927 is the largest metal-working machinery export year that the German industry has ever had.

German exports of metal-working machinery to the United States have been estimated at 2200 metric tons in 1927. This is more than has ever been sold to the United States before, even in pre-war days, with the exception of 1926, when a total of 6750 tons of German metal-working machinery was imported — an exceptional amount, indicating that importers stocked up with German machinery. A study of the price per pound of these machines, as disclosed by the export declarations, shows that the United States received German metal-working machinery at an average of 12.3 cents per pound in 1926, whereas the average price to the entire world was 17 cents per pound. The machinery shipped to the United States is either of a cheap, low-grade type, or a lower price is quoted in this market than elsewhere.

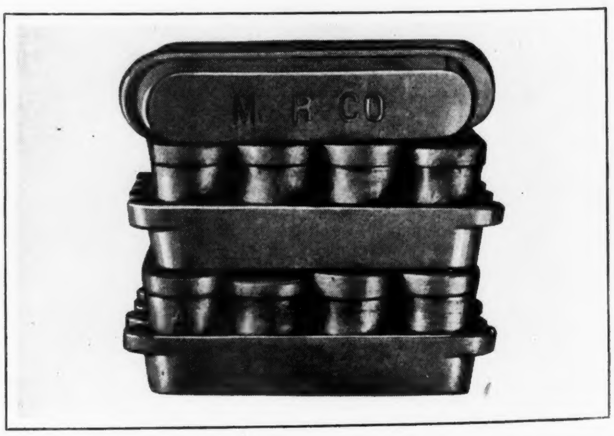


Fig. 6. Pig Tin, Weighing 55 Pounds, Used in Bronze Castings, Babbitt, and Solder

Die-casting Machine for Trial Parts

Design and Operation of a Rapid-acting Single-cavity Die-casting Machine

By H. L. THOMPSON

DIE-CASTING has generally been considered a highly specialized art and one that could only be successfully used by experts who, through a long apprenticeship, have acquired a large amount of experience and developed suitable equipment. This belief has probably diverted many good die-casting propositions into other channels, as the initial outlay for experimental die-cast parts seemed prohibitive, both on account of the expense and the delay necessary. There are times when the ability to do this work in an experimental way is of the greatest value, as in the case to be described.

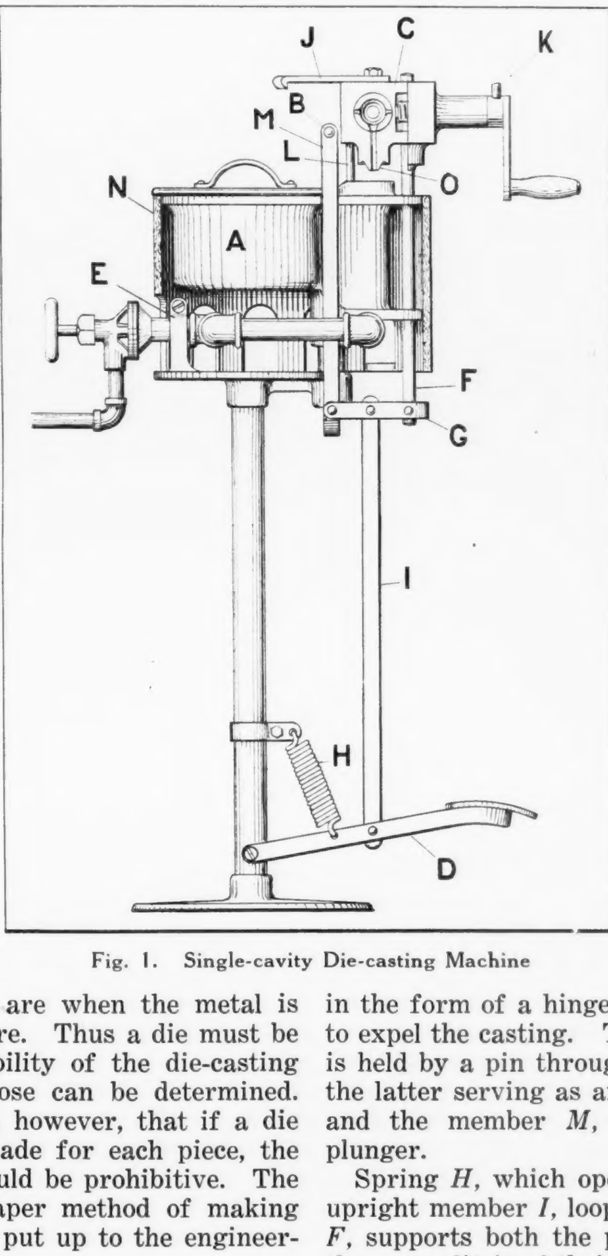


Fig. 1. Single-cavity Die-casting Machine

In this instance, it was necessary to produce a number of parts for a new device that was being developed. It was thought that these parts should be die-cast, but it was necessary to actually produce them and try them out before making a decision, as both strength and resistance to wear were of primary importance.

In searching for a practical way to make the tests, it was soon discovered that castings made from sand molds produced from experimental wood patterns would not be satisfactory, as the strength and the texture of a metal cast in sand are entirely different from what they are when the metal is cast in a die under pressure. Thus a die must be made before the practicability of the die-casting process for a given purpose can be determined. It was found in this case, however, that if a die of the usual kind were made for each piece, the cost and time required would be prohibitive. The problem of finding a cheaper method of making test die-castings was thus put up to the engineering department.

Discussion led to the conclusion that if die-castings could be made on a wholesale scale, with the usual complicated and expensive machine, they could be made one at a time with a smaller and much simpler machine; so it was decided to try building a small plunger-type machine, employing a single-cavity die that could be readily interchanged. Such a machine was built, and the following is a description of the machine and dies and the results obtained with them.

In Fig. 1 is shown a side elevation of the machine with the jacket cut away, showing it in a position to be operated. In Fig. 2 is shown the burner which melts the metal. A section through the center of the melting pot, pump, and vent is shown in Fig. 3. Figs. 4 and 5 show partial sectional views of two different dies. At *A* and *B*, Fig. 6, are shown examples of parts produced in the dies illustrated in Figs. 4 and 5.

Construction of Machine

In Fig. 1, *A* is the melting pot supported, with most of the mechanism, upon the upper end of the column of 2 1/2-inch pipe which is provided to hold the working parts in a convenient position to be handled by the operator while standing. The hairpin-shaped pull-rod is attached to the upper end of the plunger at *B*. This plunger forces the molten metal into the die *C* when the foot-pedal *D* is depressed.

The die rod *F* is really the extension of the hinge pin of the die, as each of the dies is made in the form of a hinge, so as to be readily opened to expel the casting. The lower end of the die rod is held by a pin through the U-shaped member *G*, the latter serving as an evener between the rod *F* and the member *M*, which actuates the pump plunger.

Spring *H*, which operates through pedal *D*, the upright member *I*, loop *G*, hairpin rod *M*, and rod *F*, supports both the pump plunger and die *C* at the upper limit of their strokes; downward motion of the foot-pedal lowers the die into contact with the vent *E*, Fig. 3. The same motion continued carries the pump plunger *C* down against the molten metal contained in chamber *B*, thus forcing the metal through the channel *D* and vent *E* into the die.

Operation of Machine

To make a casting, the die is closed and latched, if a latch is necessary, and pressure brought to bear upon pedal *D*, Fig. 1. The die, being heavier than the pump plunger, falls into position with the conical boss *A*, Fig. 4, in the vent bushing *E*, Fig. 3. When the boss *A* of the die is firmly seated in the bushing, further motion of the foot-pedal carries the pump plunger downward, forcing the molten metal into the die.

The pressure depends entirely upon the speed and power with which the foot-pedal is depressed. In any case, the making of the casting is accomplished almost instantly. The pressure on the foot-pedal can be removed at once, allowing both the die and plunger to be returned to their normal upper positions by spring *H*, Fig. 1. If both the metal and the die are working at the correct temperatures, no time need be allowed for the metal to set. The die can be opened immediately and the casting expelled.

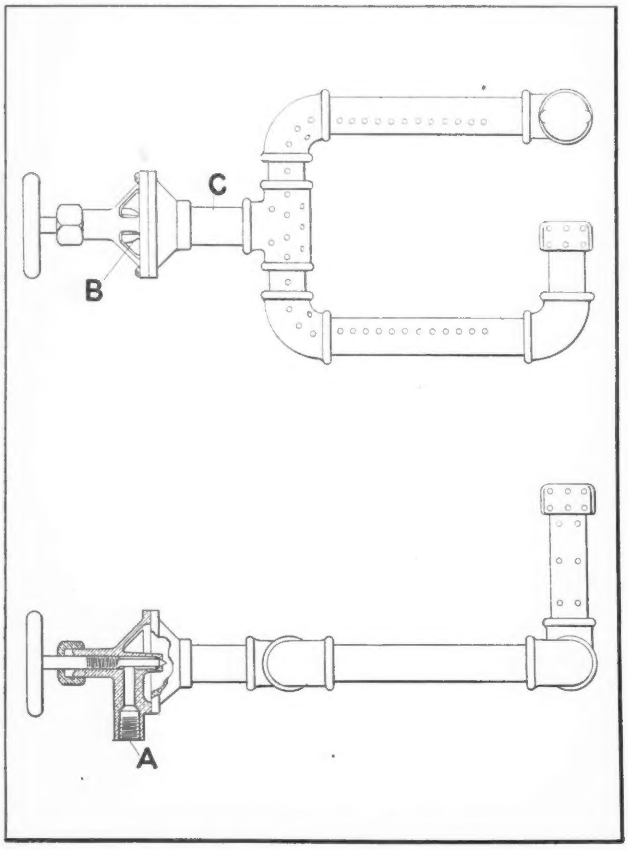


Fig. 2. Burner of Die-casting Machine

Burner for Melting Metal

The burner is shown at *E*, Fig. 1. It was made for burning city gas of 600 B.T.U., at a pressure of about 6 inches of water. No air blast was used, but good results were obtained from it on alloys melting at around 850 degrees F. The burner, Fig. 2, is composed entirely of one-inch pipe and fittings, with the exception of the fuel valve which was made special for the purpose. Gas enters the valve through the tapped opening *A*. Air enters through the holes at *B*, and is mixed with the gas as it passes through the pipe *C*. Both branches of the burner proper are drilled with rows of holes made with a No. 35 drill, the holes being 3/8 inch apart and positioned from trial, according to the performance of the burner.

With this form of burner, it is possible to lead a branch to any part of the machine that is particularly in need of more heat. This is done by removing either of the caps on the end of the branches and running a properly drilled pipe to the point where it is wanted. Smaller pipe can be used if only a small amount of heat is required. In the open air the burner was totally inadequate for heating the machine, but the addition of the sheet iron and asbestos jacket *N*, Fig. 1, provided an insulation that not only conserved the heat to a remarkable extent, but made the surroundings far more comfortable for the operator. A very satisfactory day's run could then be made on a gas consumption of about 500 cubic feet.

Importance of Maintaining Proper Temperature

With the burner shown in Fig. 2, about an hour was required to bring the machine and metal to the proper casting temperature, but after that temperature was attained, it was always necessary to greatly reduce the heat applied in order to make perfect castings. Contrary to expectations, it developed that hot metal was not only unnecessary, but that is was positively impossible to secure perfect castings with the metal at more than a very moderate temperature. In fact, the fastest and most satisfactory runs were obtained when the metal was slightly mushy, and not fully in the fluid state. It was found that the art of making a perfect casting after the die was properly built, vented, and gated depended almost entirely upon balancing the temperature of the metal and the die.

Operation of Pump which Forces Metal into Die

The cross-sectional view Fig. 3 shows the operating members of the die-casting machine. At *A* is the melting pot proper in which the pump chamber *B* is submerged. At *C* is the plunger which forces the liquid metal through duct *D* into the die. It will be noticed that no valves are employed in this pump, but that the metal is made to flow through it in one direction by the arrangement of the ports.

As the plunger is moved to the upper position, it passes the bottom of *F*, thus allowing the metal to flow into the cavity below it. The downward motion of the plunger immediately closes the opening and traps the metal with no outlet available excepting that through duct *D*. It will be readily seen that with this arrangement the pressure with which the metal can be forced into the die is only limited by that brought to bear on the plunger.

The vertical rod *F*, Fig. 1, functions as the support for the die *C* and is really a part of the die, for when the die proper is removed the rod is always taken out with it. A separate rod is provided for each die. The rod, carrying the die, slides in bearings immediately in front of the operator and between him and the opening through which the metal is forced into the die.

Metal Used in Dies

The body of the die in all cases is made of gray iron, but steel inserts are often used in order to get a nice finish and good detail where required.

Wear is another factor, of course, which must be considered, and it is usually necessary to attach steel nipple ends to the dies, as the soft iron would wear away quickly, spoiling the fit at the point where it strikes the vent bushing *E*, Fig. 3.

Cores, when required in a die, are always carefully made of steel, and if well lubricated with beeswax, they slide well in an iron guide, with very slight wear. But trouble has often been experienced with closely fitted sliding parts when the material of both members was steel.

Die for Producing Part with Thread

Fig. 6 shows a piece that was die-cast. The various die-casting companies with which the matter was taken up objected to making an attempt to cast the thread, and each advised casting the part with a cylindrical core only and then tapping the thread. The casting was to be made from a zinc base material. As a great deal of trouble had been experienced in bottom-tapping another piece similar to this, it was considered essential to cast the threads, and this was one of the reasons that led to the design of the special die-casting machine.

Single-cavity Die Met the Requirements

Fig. 4 shows the construction of the single-cavity die that was designed to produce the threaded piece shown at *A*, Fig. 6. This die proved so successful that daily runs as high as 2700 pieces were made with one machine and die which cast the thread complete. The only real trouble experienced was the occasional cracking of the casting as it shrunk on the core. Some metals, of course, are worse than others in this respect. However, it was eventually discovered that making the walls of the casting slightly thicker entirely eliminated the tendency to crack, if the die temperature was correct.

Absolutely no difficulty was occasioned by casting the thread in this piece. The thread was tapered a total of about 0.005 inch, and it would take a sharp pull on the core handle to start it, but through the remaining revolutions no effort whatever was required to remove the core. Both beeswax and beeswax and linseed oil mixed with plumbago were used to lubricate parts of the die, and whenever the core would stick particularly hard in the casting, a mere touch of either of these lubricants would cause it to run free again for a considerable period of time.

As the dies became older, the surfaces acquired a smooth brown coating, which seemed to help retain the lubricant and improved their action. A slight tendency to stick was always experienced with new dies, but a comparatively short run overcame this difficulty, except in cases where insufficient draft was allowed in some part of the die.

Method of Holding Die Shut

The die shown in Fig. 4 was required to be latched shut while the casting was being made, and it was desirable that the latch should also hold the core firmly in place in the die, so that the pressure of the molten metal would not force it out of position. The latch for this die is shown at *J*, Fig. 1. It consists of a flat steel hook, pivoted on the top center of the stationary half of the die. The hooked end of the latch is slightly diagonal and so arranged that when the die is closed and the core in position with the handle down, the latch can be swung to engage the pin *K* on the upper side of the core, effectively holding the die closed and the core in position.

Pulling forward on the core handle releases the latch automatically, so that the core can be rapidly turned out of the casting and the die opened without delay. All the dies required a latch of some kind to keep the pressure of the molten metal from forcing them open. Various kinds of latches were used, and all functioned well, though some were more convenient than others. The design of the latch must always depend upon the die, because the proper pulling of some cores will interfere with the use of some kinds of latches.

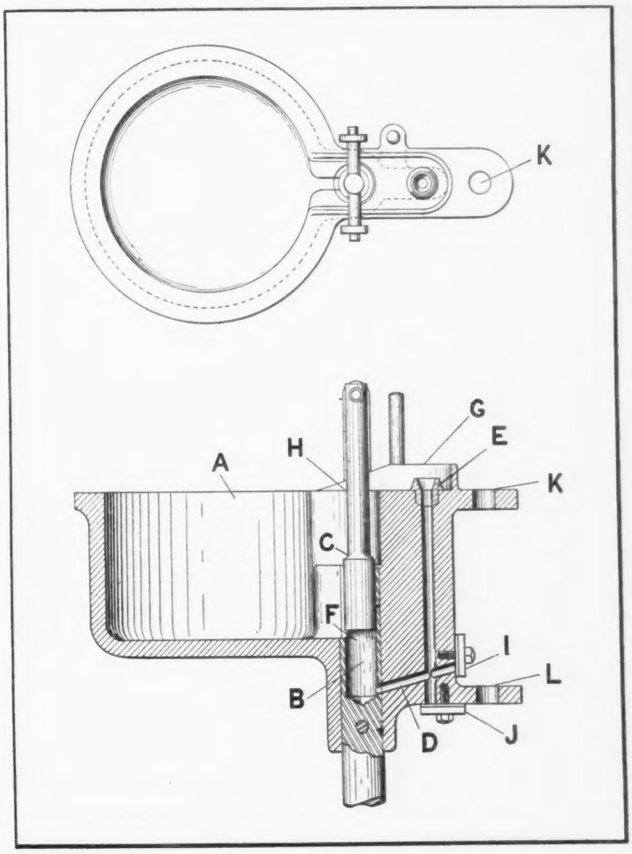


Fig. 3. Plunger Pump for Forcing Metal into Die

Metal-tight Connection Between Die and Pump

While the casting is being made, the conical boss of the die is held in air-tight contact with the vent bushing by the same pressure that is exerted to operate the pump. That is, the evener *G*, Fig. 1, is drawn down by the rod *I*, attached at its center, and both the pump plunger and the die are pulled downward with the same force. However, the area presented to the pressure on the conical connection, such as shown at *A*, Fig. 4, is so much smaller than that on the end of the pump plunger that there is no possibility of forcing the die away from the vent.

Sometimes, due to poorly melted metal or a bit of foreign matter, there will be a slight leak between the connection, and the vent and the metal will fly. To prevent the metal from spattering on the operator, a recessed shoulder is provided around and above the vent or connecting boss.

This shoulder deflects the metal back against the barrier *G*, Fig. 3, which guides it back into the pot. It is therefore impossible for the hot metal to be thrown on the operator if the die is closed, as the vent will always be closed as soon as the pedal is depressed, before the pump plunger moves.

Extracting the Work from the Die

Immediately upon depressing the pedal, it is released and the die and plunger return to their upper positions. Then the casting is expelled by turning the left half of the die until the horn *F*, Fig. 4, strikes the extractor pin *G* and pushes it forward. Dies made in this way do not need a sprue cutter, because the gate in the die can always be flattened as it approaches the cavity, so that as the casting is expelled it carries the gate with it.

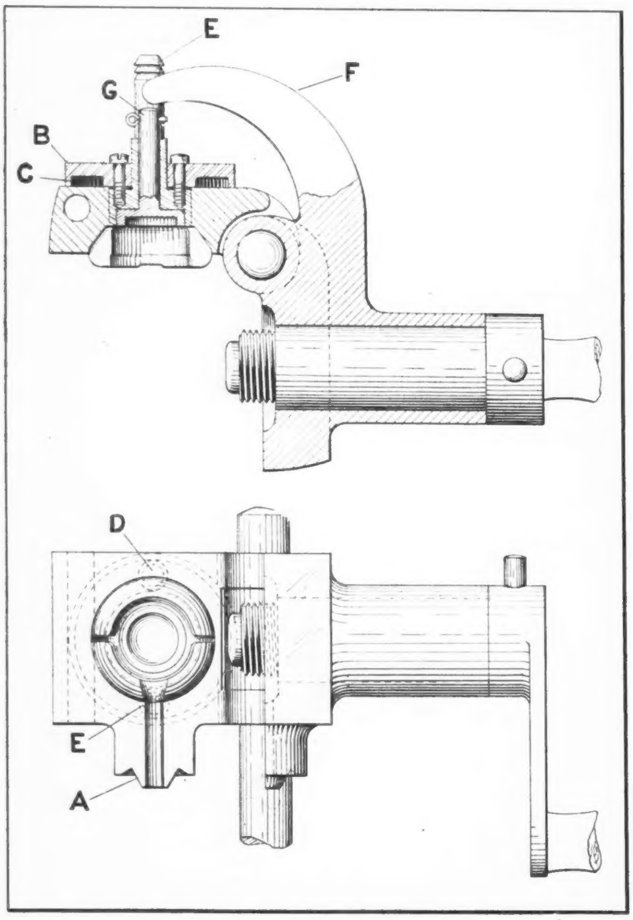


Fig. 4. Die with Threaded Core

The gate is invariably broken off as the casting falls into the receptacle. It was found that the gate arrangement made quite a difference in the castings produced, and that the best results were obtained by starting with a very small opening, increasing the gate size by trial and changing its shape until satisfactory results were secured.

Methods of Cooling Die

Venting required but little attention. It developed that there was no occasion for a particularly fine seat between the two halves of the die, as but little fin was formed on the castings as long as the temperature of the metal and the die was kept down to normal. In cases where a large flash was obtained, the casting was invariably found to be defective on account of the hot metal which would cause a draw in some part.

When the die was cold, the castings always appeared full of surface seams and had a mottled unfinished look. With the cold die, the cracking over the core was unavoidable, and unless some extra source of heat was applied to the die to warm it before starting, about twenty-five castings would be made before the temperature was brought up to the point where the piece would stop cracking. By that time the surface of the casting was greatly improved, and in the case of the die shown in Fig. 4, it became necessary to use some means for reducing its rapidly rising temperature. This rise of temperature varied, of course, with the speed of operation. A slow worker would have been able to run indefinitely without the die becoming too hot, but if maximum speed was desired, it became imperative, in this case, to use water to cool the die.

The back plate *B*, Fig. 4, was therefore recessed with a channel, as shown at *C*, which was connected at *D* and *E*, by rubber tubing, to a small tank which provided thermo-syphon cooling. A small valve in the water circuit was adjusted to give the proper temperature while running at any given speed. It was always necessary, however, to close the valve entirely if the machine was to be stopped for even a few moments, as the circulating water cooled the die below a good operating temperature very rapidly when standing idle.

Perhaps the greatest trouble experienced with water-cooling was due to the formation of scale in the water chamber of the die. The chambers, being very small, soon acquired a heavy coating. This not only restricted the movement of the cooling water, but insulated it from the metal surface, which greatly impaired its efficiency. This difficulty was eventually overcome by the use of distilled water.

After distilled water was adopted as a cooling medium, it became practical to flow the water through drilled holes in the die body instead of making a chamber or jacket. It was feared that this might crack or distort the die, but no such trouble was experienced. A 1/4-inch hole proved to have an amazing influence in reducing the temperature of a die that was being worked rapidly. Sometimes where a portion of a casting was very heavy and, through cooling slowly, caused a draw, the trouble could be entirely eliminated by drilling the water holes nearer the heavy portion in the die.

Dies used for making very light castings did not require water to cool them, as it was found that their temperature could be regulated very satisfactorily by letting the blast from an electric fan play on them. The fan was also a comfort to the operator, so that its use in cooling the die served a double purpose. To maintain the correct temperature without heat indicating instruments proved to be a matter requiring some care, but as the quality of the castings was always an index to the temperature conditions for both the metal and the dies, a little experience made it possible to control this factor satisfactorily.

Die with Interlocking Cores

In Fig. 5 is shown a die that requires no latch, as the piece to be cast necessitates cores interlocking at right angles to each other. The die is

of the same shank construction as that shown in Fig. 4, but as there are no threads to be cored, the cores in this die are pulled and restored by simple lever action. When the die is closed, core *A* passes through the opening in core *B*, effectively locking the die without the use of a latch. In working this die, after the casting is made the vertical core *A* is extracted by lifting lever *C*, while lever *D* not only pulls the horizontal core *B*, but upon the completion of the movement of the core, also opens the die, and the casting is expelled by the extractor *E*.

Supporting and Locating Die on Machine

The die is supported in the machine by the rod *F*, Fig. 1, but it is guided and held in position to insure proper registration of the connecting boss and vent bushing by the stud *L*, which could be located to suit the hole through the body of the die.

At times the stud was supported on a light bracket screwed to the machine, and a projecting lug on the back of the die was provided with a hole which served as a guide over the stud, as shown at *F* in Fig. 5. This guide was not closely fitted, as the tapered connecting boss on the die readily located itself in the vent bushing if the guide merely insured its entrance. It proved to be out of the question to hold the die in rigid alignment, as both the die boss and vent bushing seemed to wear and corrode unevenly, due to the action of the hot metal and its oxides. A floating location for the die, however, simplified the problem of maintaining a metal tight fit at this point.

Design of Ejector

The ejector *G* of the die shown in Fig. 4 is always forced to the casting position by the end of the threaded core when the die is closed. The ejector *E* of Fig. 5 does not have this advantage, as the core *B* does not reach far enough into the die. However, it does enter far enough to push the ejector back where the pressure of the molten metal entering the die will insure its seating the rest of the way.

Various kinds of springs for the same purpose were tried in other dies, but the heat was so intense that they did not last long. In some cases, it was necessary to locate the spring at a distance from the machine and connect it to the knock-out by a small wire. This method functioned well, but was somewhat a nuisance at times. It was found that oil-holes should be provided where possible for every moving member of the die, including the ejectors, as the least friction between the members at casting temperatures was likely to cause serious cutting. Though beeswax served well as a lubricant, it did not spread well between the surfaces, so every facility was necessary to insure its entrance into the bearings where it was required.

Melting Temperature of Metals

Most of the metals likely to be used for die-casting melt at a temperature of less than 850 degrees F. Aluminum, of course, is an exception; while it was never tried in this machine, it is reasonable to believe, that it could have been used, as the temperatures obtained were more than sufficient to melt it. It was often amazing to see how different similar appearing metals would act in the dies.

No great change in temperature of the metal could be allowed while running any particular die. Metal just barely molten generally gave the best castings, but this may have been due to the fact that in this machine extra heat was applied to the duct by running an extension from the burner up one side. This was done to insure against the clogging of the duct by chilled metal, and may have provided enough extra heat to show a decided difference between the temperature of the metal in the pot and that passing into the die during the casting process.

It was an easy matter to raise the heat to where the castings would all be spoiled by cracking, undue porosity, or shrinkage draws. This condition

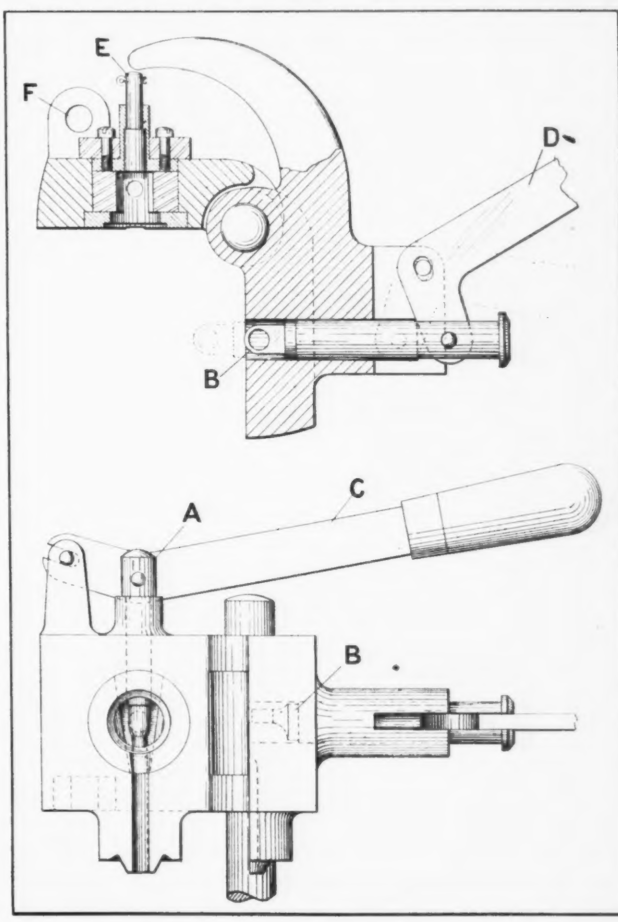


Fig. 5. Die with Interlocking Cores

could always be readily indicated by the size of the fin or flash in the casting at the die parting line. It was a matter for judgment, however, as to whether this condition came from a die too hot or metal too hot or both. A pyrometer of some kind would undoubtedly have been a great help.

In operating the machine, it was found best to set the burner high enough to keep the heat normally increasing; then to operate the dies fast enough so that the new cold metal added to the pot to maintain the supply would just hold the heat even. Good castings were always secured, though the metal in the pot was partly composed of solid pieces in the process of melting.

Design of Pump Plunger

A steel plunger was originally provided for the pump, but trouble was soon experienced from its

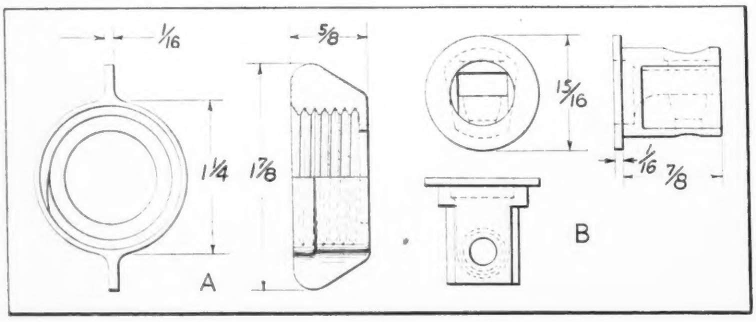


Fig. 6. **Parts Produced in Dies Shown in Figs. 4 and 5**

sticking in the barrel. As the barrel of the pump was merely the hollowed out end of the steel upright which supports the pot, it brought steel and steel together in a situation where a good fit was necessary and no means possible for lubrication. To overcome this, a steel shank was provided for the pump plunger, but the enlarged end was obtained by screwing a gray iron bushing on the previously threaded shank. No further trouble was experienced with the plunger sticking from friction with the barrel, but it was necessary to remove and clean it from time to time to get rid of the oxide that was bound to accumulate and interfere with the proper action of the pump.

About 0.003 inch shake was allowed between the plunger and barrel with good results. At times, when the plunger wore, or the metal was too hot, there would be some tendency for the metal to shoot past the plunger, but even when this occurred, it could be prevented from doing harm by keeping the level of the metal in the pot high enough to cover the plunger well.

Originally it was the practice to support the upper portion of the shank of the pump plunger in a bearing at *H*, Fig. 3, but so much trouble was caused by metal and metal dross getting between the shank and bushing that better results were obtained without the support. It was intended to make a longer shank and place the bearing above the cross-bar where no metal could touch it, and this would probably have worked well, but the success secured without it made the extra work seem unnecessary.

Keeping Metal in Proper Condition

If the metal in the pot becomes too fluid, there is some tendency toward separation into its elements by gravitation, so it is advisable to stir the contents of the pot from time to time. Another reason for keeping the level of the metal high lies in the danger of getting the floating dross into the pump. This will happen at times in spite of care, and may result in partial stoppage of the duct, which will cause the castings to run short. The clamps at *I* and *J*, Fig. 3, cover the blind ends of the duct openings by pressing asbestos gaskets against them. In case the holes become clogged, easy access can be obtained for clearing them out, even though the contents are so hard that drilling is necessary.

The bearings *K* and *L*, Fig. 3, in which the die rod is guided, should be lubricated to facilitate a smooth motion. This is not easy, on account of the intense heat. Of course, the rod fits very loosely and never binds, but it gets rough from continued use, and it was found that plumbago and linseed oil had some staying qualities and improved matters if applied from time to time.

Chute for Conducting Castings from Machine

When running at a rapid rate on production work, a sheet-metal chute was inclined from a point near and to the left of the die to catch the hot casting as it was shot out of the die by the ejector. The chute led into a suitable receptacle on the floor by a gradual slant, so that the hot and still very fragile casting would not be cracked or broken. If the gate did not break from the casting at this point, subsequent handling invariably performed this operation. The fins were removed from most of the castings by tumbling, so no further handling was necessary.

Finishing Castings

Tumbling gave the castings a burnished appearance that made every imperfection show up. For this reason, it was hardly advisable for castings that were not to be plated or finished in some way. However, most of the pieces were either plated or enameled, so the tumbling was a real help. Where the original bloom was wanted on the castings, the fins were removed by filing or grinding.

Many castings were produced on this machine other than those shown here. Smaller pieces were often cast in groups at one operation, when the quantity needed warranted such practice. Good results were invariably obtained, though not always at the first attempt. The machine was made primarily to facilitate experimental work by providing means for working a cheap single-cavity die. It actually was used chiefly for rapid-production work, because it proved to be capable of this service. It was cheap to build, inexpensive in operation, and often a die for a simple piece could be made in a few hours, as castings for the frames were kept on hand and machined as blanks in quantities.

Operating the machine on production work was a task for a good man. It was not pleasant to stand the heat nor the constant pedal work, and if there were cores to pull, it was sometimes very fatiguing, but the quantity of work turned out made it possible to pay a good piece-work rate, so that it could be made attractive to a man of sufficient training to gage his heat and pressures properly. Of course, the operator was always required to wear goggles and canvas gloves while working the machine, but no workman has ever been injured in operating the machine.

* * *

POWER TRANSMISSION MEETING

The first regional meeting of the Power Transmission Association, comprising manufacturers and distributors of power transmission equipment, supplies and accessories, was held at the Poor Richard Club, 1319 Locust St., Philadelphia, Pa., Friday evening, February 3. Similar regional meetings will be held in New England, Detroit, Chicago, Cleveland, and other industrial centers.

Forging Pipe Couplings

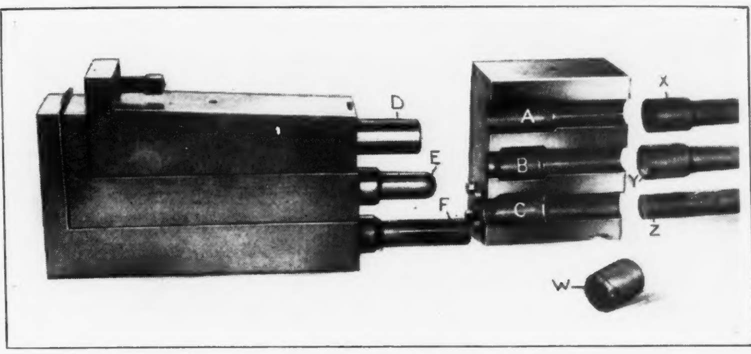


Fig. 1. Equipment Employed in Forging Pipe Couplings in Three Operations

DIES and tools of the general design shown in Figs. 1 and 2 have been made by the Acme Machinery Co., Cleveland, Ohio, for forging pipe couplings from bar stock. Standard couplings from 3/4 inch to 2 inches have been produced by this method in lengths up to 2 inches. Three strokes of the forging machine are required with the equipment shown in Fig. 1, whereas only two strokes are performed with the die set illustrated in Fig. 2. A feature of both die sets is the manner of punching off the coupling without any loss of stock. Whether a forging should be produced in two or three operations on a machine, depends primarily upon the size of the coupling and the material from which the work is to be made. Small couplings are usually the hardest to forge.

In using the die equipment shown in Fig. 1, bar stock heated to a forging temperature is extended into impression *A* of the stationary gripping die until the stock comes in contact with a stop. Then, with the stroke of the machine, the movable die first closes tightly against the stationary die, so as to grip the stock firmly and form a complete circular hole. As the machine completes its stroke, the heading tool *D* advances into the forward end of impression *A* and produces an enlarged head on the bar stock, as shown at *X*.

For the second operation, the enlarged end of the stock is placed in impression *B* of the stationary die. Then with the next stroke of the machine, the movable die closes and a hole is punched in the stock as tool *E* advances into impression *B*. The appearance of the work then is as illustrated at *Y*. For the third operation, the stock is placed in impression *C* and when plunger *F* advances into the closed dies, the coupling is sheared off as shown at *W*, the bar stock being left plain, as seen at *Z*. In making 1-inch couplings in two operations, the production averages about 650 per hour.

Punch *F* is made hexagonal in back of the punching end, so as to facilitate stripping off the couplings. The punch end must fit the die closely to insure that the couplings will be cut off clean. Die-blocks for operations of this kind are usually made from chrome-nickel steel, while the plungers and any inserts required in the dies are made of tool steel.

When the dies shown at *A*, Fig. 2, are employed, the first operation, which is performed in the upper impression, consists again of upsetting the front end of the stock to the outside diameter of the coupling by means of the heading tool *B*. The second operation consists not only of forming the hole in the coupling with plunger *C*, but also of punching off the coupling to length by means of the same plunger. At *D* is shown the type of shank by means of which tools *B* and *C* are held to the ram block of the machine, and at *E* is shown the type of nut by means of which the plungers are fastened to their respective shanks. When using two-operation dies to produce 1 1/4-inch couplings, the production averages about 500 per hour.

* * *

The section of the transcontinental air mail route between Chicago and San Francisco probably presents wider extremes of conditions than any air line in the world. The altitudes of the various landing fields vary from sea level to 6400 feet. Part of the route is over flat prairie country and part is over mountain ranges that force the planes to fly as high as 15,000 feet. The ground temperatures in the summer may run as high as 130 degrees, and in the winter they drop as low as 45 degrees below zero.

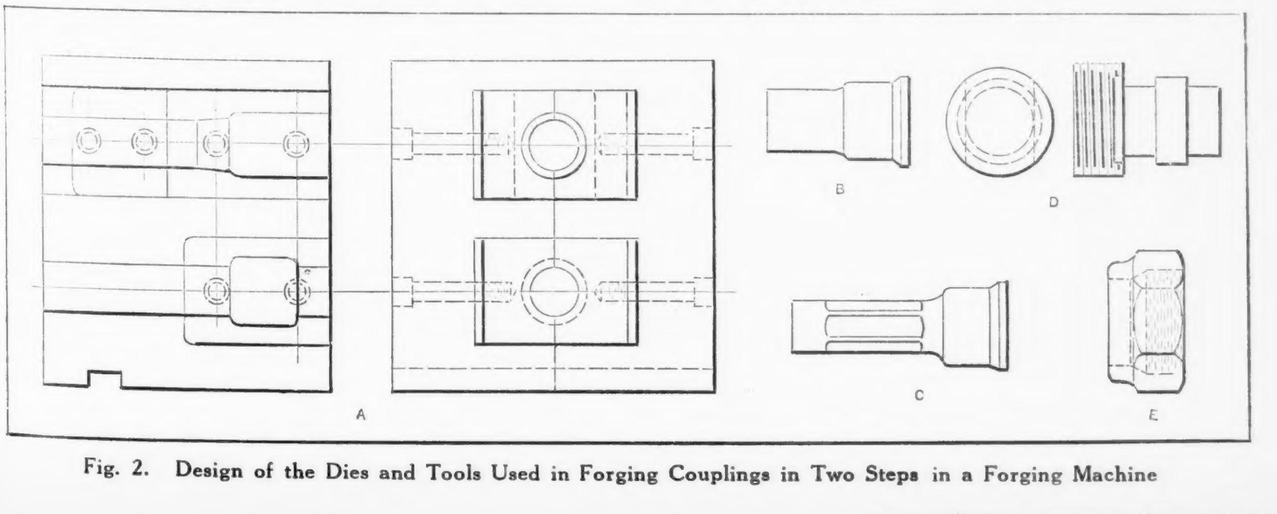


Fig. 2. Design of the Dies and Tools Used in Forging Couplings in Two Steps in a Forging Machine

Coil Spring Specifications

By RUDOLPH A. JOHNSON,* Morgan Spring Division, Wickwire Spencer Steel Co., Worcester, Mass.

IT is the object of this article to provide an outline of the factors to be considered in drawing up coil spring specifications for quantity manufacture. The outline has been prepared primarily for the convenience of designers and draftsmen, but can be profitably employed by buyers generally to check the completeness and consistency of the specifications for a given spring.

Incorrect or incomplete specifications are commonly encountered in the spring trade, and are the cause of much unnecessary correspondence, loss of time, and sometimes loss of good will. Overdeveloped specifications too often fail to take into consideration the variables with which the spring manufacturer must contend, and they are accordingly likely to result in unnecessarily high quotations and delayed deliveries. The following outline is the result of considerable experience in drawing up spring specifications for production.

Three factors—namely, assembly, operation, and manufacture—must be considered in preparing coil spring specifications. Springs that are assembled into parts by automatic machinery or jigs must often be made with less variation than the actual operating conditions of the springs would require. Then, again, springs that are not designed to withstand solid compression without becoming set, and that do not receive solid compression in use have often been ruined as a result of being set solid when assembling; hence, the necessity for considering the assembling methods.

Operating conditions must be studied for any abnormal factors, such as excessive heat, rapid action, suddenly applied loads, and corrosion. Manufacturing conditions must be considered from the viewpoint of cost and delivery. Freak designs or the use of special materials and odd sizes results in slow deliveries. Too close tolerances increase the cost.

In this outline, the specifications affecting the mechanical problems of assembly and operation must be considered under the headings "Static Specifications" and "Dynamic Specifications."

Static Specifications—Under this head are considered the specifications or dimensions that limit the allowable free size, shape, and position of the springs. These specifications and their limits determine the method of manufacture and assembly, and to some degree control the cost of the springs.

Dynamic Specifications—Specifications in this class pertain to the work the springs must do and the conditions under which they work. These specifications control the design of the springs and determine the materials from which they are to be made. To be thoroughly effective, every item mentioned in this outline must be checked with the specifications. Since the object of the list is to secure completeness, its purpose would be defeated by the omission of any one item. It usually happens that the single item omitted is a vital one.

Helical Open-wound Compression Springs

Static Specifications—Material: The kind, shape, and size of wire should be checked against the working specifications. It should be noted that the wire size may be approximate and incidental to load test, the selection being left to the spring manufacturer's judgment. When given, the size should always be expressed in decimals of an inch.

Type: The style of the ends, whether plain, plain ground, squared only, or squared and ground, should be specified. These types of ends are illustrated in the accompanying table of formulas.

Dimensions: Give the maximum allowable outside diameter of the spring, or give the hole size and desired clearance. Give the minimum allowable inside diameter of the spring, or give the rod size and desired fit. The maximum and minimum free lengths must be specified. If no load specifications are given, it is well to define the length limits; otherwise, the length may be left as approximate and incidental to the load test, the uniformity being taken care of by the tolerance given on the load test. Also note whether the spring is to be wound left-hand or right-hand—in other words, counterclockwise or clockwise. Usually springs produced on automatic machines are wound left-hand. Give maximum solid height and number of coils, pitch or lead—see table.

Finish: Specify the finish, whether plain, tumbled bright, blued, japanned, rustproofed, plated, or galvanized.

Dynamic Specifications—Check the following questions which pertain to the load specifications: What is the desired strength of the spring? What are the weakest and strongest springs acceptable in terms of pounds of load for any given deflection? What is the assembly and working range of the spring? How many times per minute is the spring compressed? Are the loads gradually or suddenly applied? Are the springs compressed solid when in use? How about settage? Is the temperature surrounding the spring abnormal? Are the springs subject to corrosion? (The last two factors are of vital importance in determining the kind of material to be used.) What degree of precision is required? Will inspection in detail be required?

Explanation of Table of Formulas

All calculations should be made in decimals of an inch. For the general run of compression

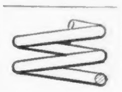
*RUDOLPH A. JOHNSON, after graduating from high-school, spent between four and five years in the automobile engine repair business. Following this, he became connected with the Morgan Spring Division of the Wickwire Spencer Steel Co., with whom he has been associated for the last three years. He was first employed as inspector, and then transferred to the engineering department, where he "translated" the design specifications of the company's customers into manufacturing information for the mill. During the last two years he has been chief inspector. For a period of years he has taken a number of correspondence courses in engineering and allied subjects. He is a member of the Worcester Chapter of the American Society for Steel Treating.

springs, the formulas given in the table may be relied upon. Avoid the necessity for close calculations whenever possible. If this cannot be done, the formulas in the table will indicate the correct procedure, but close attention must be paid to the allowances for squaring and grinding. The squaring is accomplished by reducing the pitch of the end coils so that they touch the adjacent coils, thereby providing a firm bearing and a surface that can be ground at right angles to the axis of the spring within reasonably close limits of accuracy and at a reasonable cost.

For example, if we have a squared and ground end spring with 12 coils of 0.207 inch diameter wire and we wish to know the solid height, we use the formula $W(N + 1) - W$. In working out this formula, it was assumed that one-half of one thickness of wire would be ground off each end. Substituting actual figures in the formula, we have $0.207\ (12 + 1) - 0.207 = 2.484$ inches. If this spring were ground down to a 100 per cent bearing surface, an additional 1/16 inch of metal might be removed, and again, if the springs were not ground as much as might be considered a normal amount, the solid height of this particular spring would be greater than that calculated. If a plus or minus tolerance of 1/4 coil were allowed, the solid height on the plus variation would be $1/4 \times 0.207$ or 0.052 inch greater than the normal calculated height.

These formulas will provide a positive check on the methods of figuring finished dimensions of springs after certain essentials have been determined from standard load deflection formulas. They can be used, for instance, to make sure that the pitch, length, and number of coil specifications for a given spring are consistent.

Formulas for Compression Springs

Style of Ends		Pitch or Lead	Total No. of Coils	Free Length	Solid Height
	Plain	$\frac{L-W}{N}$	$\frac{L-W}{P}$	$PN+W$	$WN+W$
	Plain Ends Ground	$\frac{L}{N}$	$\frac{L}{P}$	PN	$W(N+1)-W$
	Squared Only	$\frac{L-3W}{h}$	$\frac{L-3W}{P}$ + 2 coils	$Ph+3W$	$WN+W$
	Squared and Ground	$\frac{L-2W}{h}$	$\frac{L-2W}{P}$ + 2 coils	$Ph+2W$	$W(N+1)-W$

L = length; W = one diameter of wire; P = pitch; N = total number of coils; h = number of active coils.

Machinery

Helical Close-wound Extension Springs

Static Specifications—Material: What kind, shape, and size of wire is to be used? Is it allowable to change the size of wire, if necessary, to meet load requirements?

Type: There are innumerable kinds of special hook and loop ends made for close-wound springs. Special ends must be carefully dimensioned. A description of the methods of fastening should be given to the manufacturer whenever possible.

Dimensions: The number of coils and their direction of winding, or the length of the coil body, or both, should be given. The length over-all, including the ends should be given.

Finish: (See specifications for compression springs).

Dynamic Specifications—These include the initial tension desired, that is, the load the spring will sustain before any opening between the coils becomes apparent or before the spring elongates appreciably.

The scale of the spring or the load: The scale of the spring or the load to be carried at given extensions should be specified. The range of deflection and the number of deflections per minute should be specified, as well as the maximum stretch the spring must withstand without setting.

Torsion Springs

Static Specifications—Material: What kind, shape, and size of wire is to be used?

Type: Which of the many types of torsion springs is to be used? Each type must be considered as being in a class by itself. However, the essentials of torsion springs, as given in the following, apply generally.

Dimensions: Is the spring to be open- or close-wound? Right- or left-hand? (This is most important in the case of torsion springs.) What is the length over-all and the variations allowed? What is the minimum allowable inside diameter? In this connection, it must be remembered that the inside diameter of torsion springs decreases as the springs are deflected through an angle. If they are snug enough to bind on the working part, they will set, and eventually break. What is the maximum allowable outside diameter? What is the length of the ends and the allowable variation? (Remember that an end tends to draw in or shorten as the spring is worked.) The position of the ends and the allowable variation are important considerations in this type of spring.

Finish: (See compression springs.)

Dynamic Specifications—The dynamic specifications include the following subjects: Work the spring is required to do (furnish parts if possible); necessary strength and elastic qualities (check load and settage). A working part is more useful and important in making up torsion springs than in making any other type. Close attention must be paid to the design of the ends of torsion springs. Many types of ends are used, and it is important that the ends be held within certain limits. A manufacturer may require an allowance of plus or minus 20 degrees or more in the free position.

A bare sample of a torsion spring without supplementary information as outlined gives the makers insufficient information. Difficulties with the torsion type of spring are often encountered when

complete information regarding the working conditions of the spring is not furnished.

Summary of Important Points

If a spring is so designed that it will not stand the stress imposed upon it by a given deflection, it will take a set; that is, it will not recover its original free length. This point must always be watched. It would be difficult to consider the phenomenon of settage in detail here, for it occurs in many different ways. The smaller sizes of first-class oil-tempered wire will withstand safely, stresses up to 100,000 pounds per square inch. Larger sizes should not be stressed beyond 60,000 pounds per square inch. Where it seems impossible to design a closely confined spring without exceeding the safe stress, a spring manufacturer should be consulted.

Ground-end springs are subject to burrs on the outside and inside edges of the flat ends. If these are objectionable, an added operation may be required for their removal. The necessity for removing the burrs depends upon the diameter specifications of the confining parts, that is, the clearance between the spring and the rod or hole in which the spring operates.

As there are many systems of wire gaging in use, it is always well to specify the wire size in decimals of an inch in order to avoid confusion. Precise requirements regarding load specifications, close fits on the diameter, and the ability of springs to stand square with their axes often necessitates the inspection of each part in detail, and reworking operations are frequently necessary, which involves additional expense. The following is a typical quotation from a spring manufacturer's catalogue. "If the variation allowance (in load) is less than 8 per cent, plus or minus, an advance price will apply, if order is taken at all." Good commercial springs sold without detail inspection have a plus and minus variation of 10 per cent from the specified loads.

The load-carrying capacity of springs varies as the fourth power of the wire size and as the third power of the mean diameter of the spring. The variations with which a spring manufacturer must contend are numerous and difficult to control. It is hardly reasonable, as is often done, to apply closer tolerances to springs than to screw machine products or machine parts. Trouble occasionally arises from excess variation in components of an assembly other than the spring. In checking over a design, be sure that a generous allowance on the spring will not overlap allowances on other parts of the assembly.

Methods of Submitting Specifications

Specifications for springs are submitted to the manufacturers in many forms. Perhaps the most desirable is a blueprint, containing complete specifications, from the steel analysis to the complete specifications of the finished spring. Next in order of preference comes the satisfactory sample spring accompanied by an explanation of its use and the amount of direction of allowable tolerances on every important dimension. Sometimes a partially correct sample, an incomplete sketch, or working parts are sent in to show the manufacturer what is wanted. The method of supplying specifications is unimportant to the manufacturer, provided complete information is given and the various items comprising the specifications are consistent.

It is not sufficient to furnish the manufacturer with a single spring. A complete set of specifications for duplication in large quantities is necessary, whether or not the manufacturer made the sample spring or some like it. He cannot guarantee that every spring of a large order will exactly meet all specifications. In some cases, imperfect springs are submitted as samples for duplication. The customer does not always take the trouble to check or inspect the spring, and the manufacturer does not know that the sample spring is imperfect or distorted. Under such conditions, the duplicate springs give trouble.

If springs are desired like those previously furnished, reference should be made to the order which was found satisfactory. Any reliable manufacturer is only too willing to assist prospective customers in preparing their spring specifications. Many large manufacturers maintain engineering staffs on which the customer is free to call for information and advice.

* * *

TAPPING SPEEDS FOR ACME THREAD TAPS

By A. L. VALENTINE

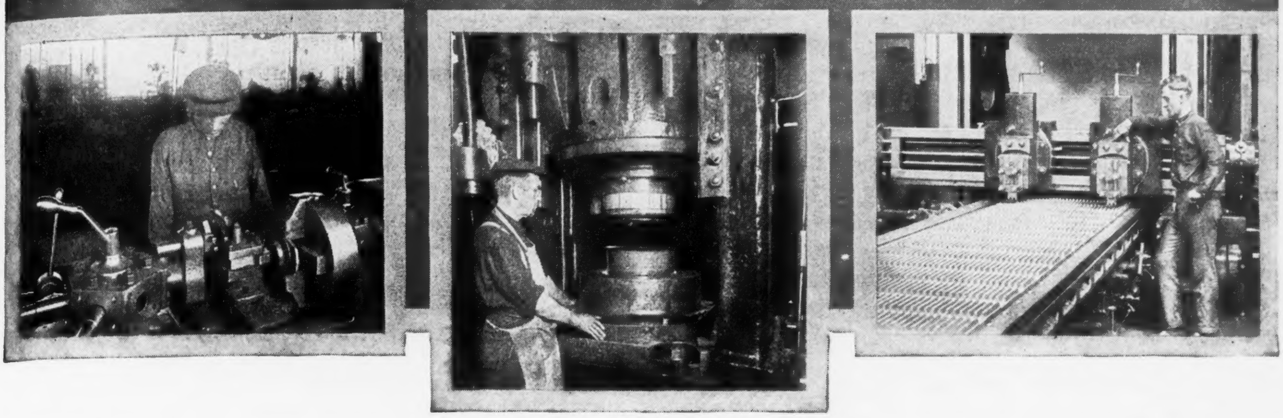
The useful life of a tap depends to a large extent on the speed at which it is driven. The accompanying table is intended to serve as a guide in choosing a trial speed when beginning a tapping job. The results obtained by trying higher or lower speeds than those specified will, of course, determine the speed actually employed for production work. A similar table giving the tapping speeds for machine tapping of nuts with carbon-steel taps of U. S. S. or Whitworth standard threads appeared in January MACHINERY, page 354. The table accompanying the present article applies to Acme taps made from carbon-steel with ordinary single threads. Acme taps with coarse leads having double, triple, or quadruple threads must be run at slower speeds, but just how much slower can only be determined by actual trial. For square-thread taps, a reduction of about 20 per cent should be made in the speeds given in the table.

Speeds for Tapping with Acme Thread Taps

Diameter of Tap, Inches	Material to be Tapped			Diameter of Tap, Inches	Material to be Tapped		
	Steel	Cast Iron or Bronze	Brass		Steel	Cast Iron or Bronze	Brass
	Revolutions per Minute Corresponding to Peripheral Speed, in Feet per Minute, Given Below				Revolutions per Minute Corresponding to Peripheral Speed, in Feet per Minute, Given Below		
	4 Feet	5 Feet	5¾ Feet		4 Feet	5 Feet	5¾ Feet
1/2	31	37	43	2	8	9	11
5/8	25	30	35	2 1/4	7	8	10
3/4	21	25	29	2 1/2	6	7	9
7/8	18	21	25	2 3/4	6	7	8
1	15	19	22	3	5	6	7
1 1/8	13	16	19	3 1/4	5	6	7
1 1/4	12	15	18	3 1/2	4	5	6
1 3/8	11	13	16	3 3/4	4	5	6
1 1/2	10	12	14	4	4	5	5
1 3/4	9	10	12				

Machinery

Letters on Practical Subjects

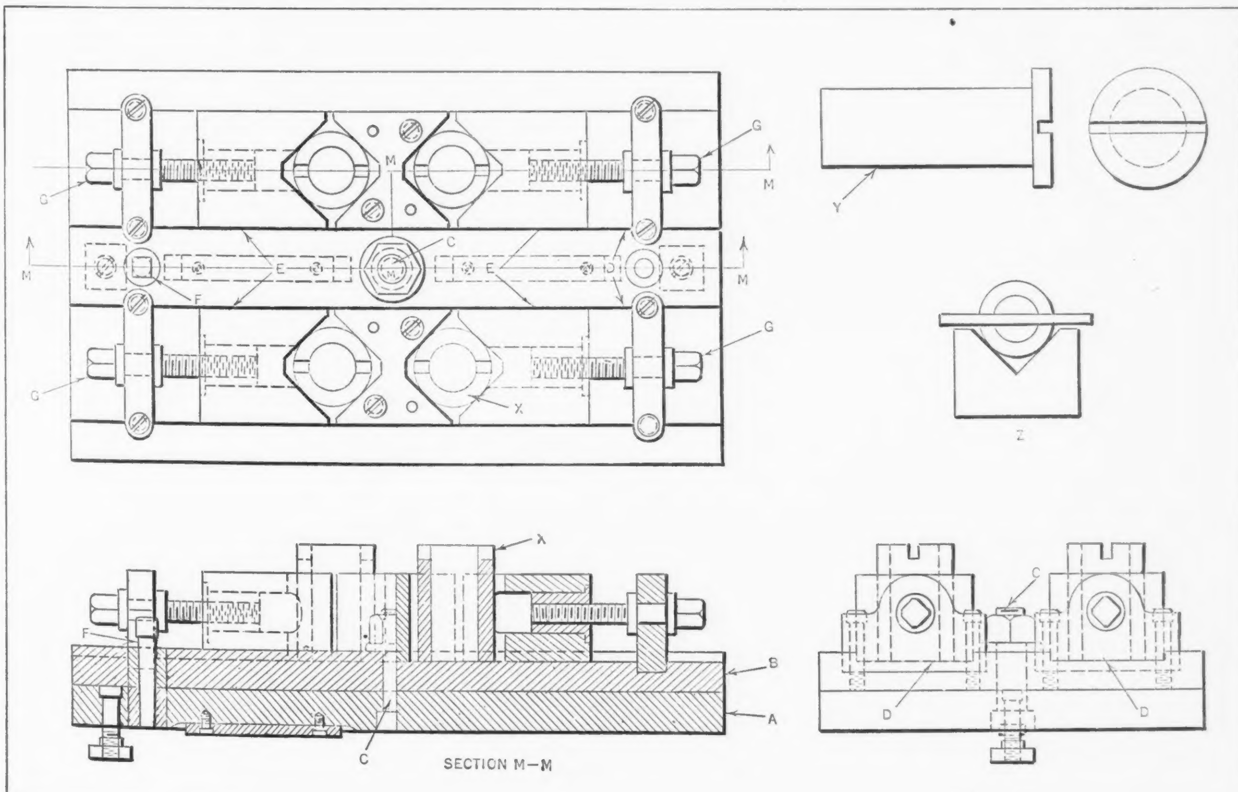


MILLING FIXTURE FOR SLOTTING BUSHINGS

A short time ago the writer was asked to make a fixture for use in one of the production departments. The operation for which the fixture was required consisted of milling slots in the ends of bushings like the one shown at *X* in the illustration. These bushings have an outside diameter of 2 inches, a length of 2 1/2 inches, and a hole through the center 1 1/4 inches in diameter. The slot milled in the top is 1/4 inch wide and 1/4 inch deep, and is required to be centered very accurately. In fact, when a flat parallel bar is placed in the slot and the bushing located on a V-block, as shown at *Z*, the slot, as shown by a test indicator, must not be off center more than 0.001 inch. With the old method these pieces were slotted one at a time, a set of V-block jaws in a regular milling machine vise being used to hold the work. In this case one man operated two machines.

The new milling machine fixture designed to handle the work is shown in the illustration. After installing two fixtures of this improved type, a time study showed that approximately eight pieces were produced in the time required to finish two pieces by the old method. In setting up the fixture, a bushing is placed in each of the four V-openings, and the screws *G* are tightened. A master plug *Y* is then placed in one of the bushings, and the milling cutter set to line up with the slot in the master plug. Care should be taken to see that the locating pin *F* is tight and that the binding nut on screw *C* is tightened sufficiently to lock plates *A* and *B* in place.

After the fixture has been properly located, the milling machine is set in operation and a slot cut in the pieces held in two of the V-openings. When the cut has been completed, the indexing pin *F* is removed and the work-holding plate indexed 180



Fixture for Milling Slots in Bushings

degrees, bringing the other two pieces into position for milling the slots. While the cut is being taken, the operator removes the two finished pieces and replaces them with new ones. The fixture can, of course, be readily equipped with holders for special work.

The cast-iron baseplate *A* is about 1 inch thick and has a tongue fitted into the bottom surface which fits the slot in the milling machine table. The plate *B* swivels on top of plate *A* about the shoulder-screw *C* which is fastened in plate *A*. In milling slots *D*, particular care is taken to have the centers of these two slots exactly the same distance from the center of the swivel screw *C*. The double-end V-block in the center of slot *D* is secured to plate *B* by screws and dowel-pins. The holes for the tapered pin bushing *F* at each end of the fixture were made and the bushings *F* were fitted after the plates *A* and *B* had been assembled.

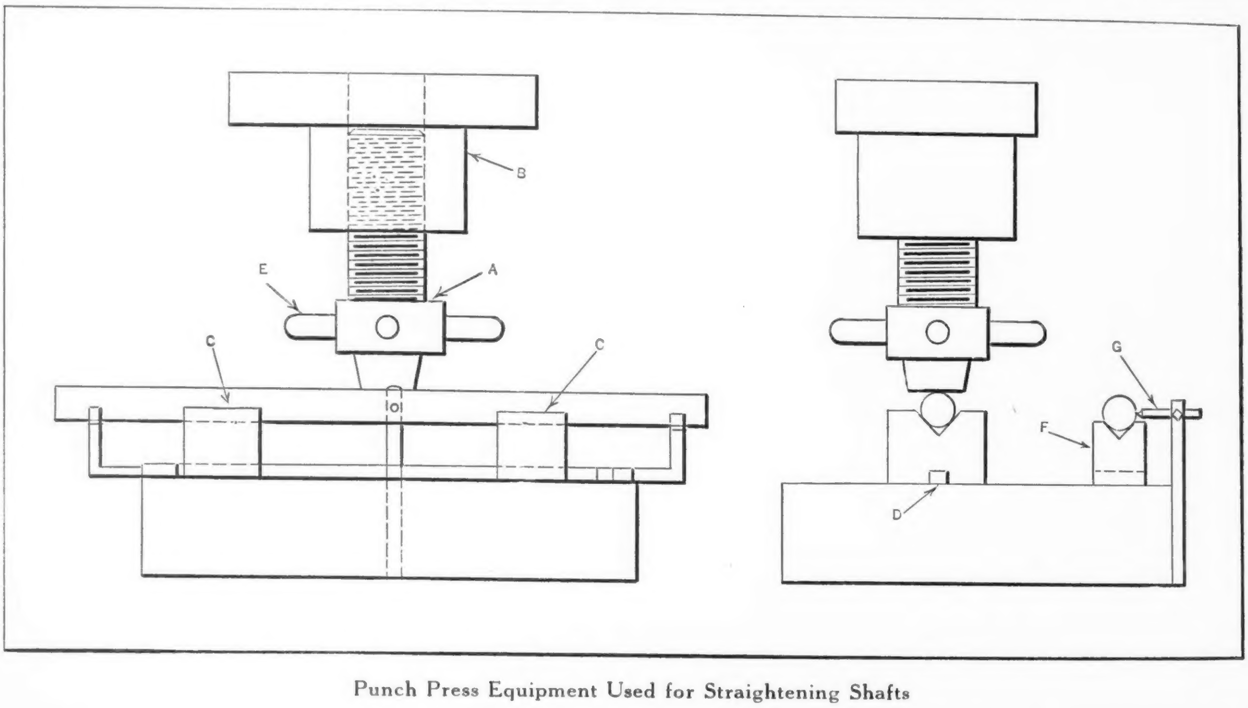
Cleveland, Ohio — WILLIAM WILSON

STRAIGHTENING SHAFTS ON PUNCH PRESS

When large quantities of shafts are to be straightened, some means of obtaining rapid production is, of course, desirable. In some instances, special machines have been developed for this work, although many of these are rather limited with respect to the range of work they will handle, and in many cases they are built for one job only. There are several well-known methods of straightening shafts, but they are generally too slow and expensive for production purposes. About the cheapest and most efficient method the writer has come across is the punch press method employing the attachment here illustrated, which can be applied to an ordinary press, and will handle a wide range of work at good production rates.

The upper striking member *A* is threaded to fit a holder *B*, which is bolted to the ram of the press. Two sliding V-blocks *C* are employed to hold the work. A keyway cut in these blocks engages a key *D* secured to the bed of the press for the purpose of aligning the blocks in the proper position under the striker *A*. By means of the handles *E* the operator can adjust the striker for light or heavy blows, and the blocks *C* can be adjusted in or out for making short or long bends. Two V-blocks *F* are conveniently located at the front of the press for testing the amount of "run out" by means of the indicating point *G*. A dial test indicator may be used in place of the pointer for close work. The operator soon becomes expert and easily straightens shafts up to 2 inches diameter by 6 feet long.

Syracuse, N. Y. — H. L. WHEELER

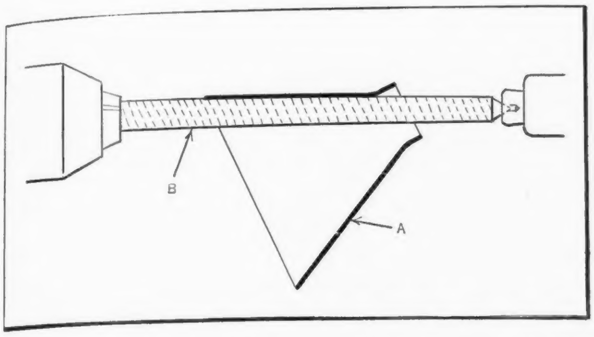


Punch Press Equipment Used for Straightening Shafts

FINISHING CAST-ALUMINUM FUNNELS

In the accompanying illustration is shown a cast-aluminum funnel *A*, which is about 6 inches in diameter and 1/8 inch thick. This funnel is part of an automatic weighing machine for a chemical, the nature of which necessitates a very smooth finish on the inside of the funnel. Ordinary turning methods were first tried as a means of finishing the inner surface of the funnel, but the unavoidable irregularities in the castings made chucking difficult, and the time required for turning and polishing was excessive. After searching for other methods of finishing, the one shown in the illustration was tried with so much success that it has been permanently adopted.

A 12-inch round file *B* is ground to a point on one end to permit it to be supported in an internal center held in the lathe tailstock. The other end of the file is gripped in the drill chuck as shown. The lathe spindle is run at high speed. By manipulating the funnel by hand to give a combined rotating and axial motion, the rough surface is quickly removed. Kerosene is applied to the file as a cutting lubricant. A bright polish is obtained by wrapping emery cloth of a suitable grade around the file in such a manner that the rotation of the file, when in contact with the funnel, tends to keep the emery cloth tightly wound in place.



Method of Finishing Aluminum Casting with Round File Held in Lathe Spindle

It will be noted that the teeth of the round file are cut in the form of a helix, so that when the file is rotated rapidly, it presents a series of cutting edges which overlap and have a shearing effect. A lamp placed so that it reflects light on the inside of the funnel facilitates the cleaning up of rough spots when finishing the filing operation.

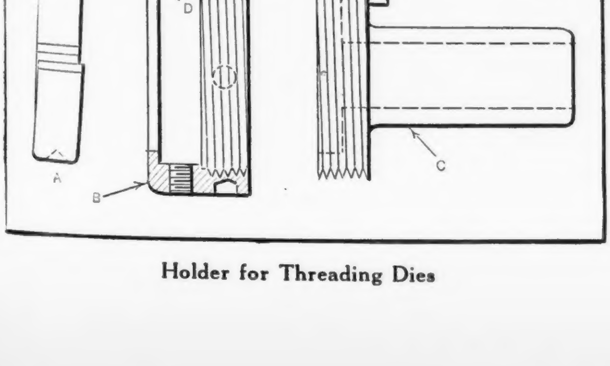
Auburn, N. Y. WALTER S. BROWN

IMPROVED HOLDER FOR THREADING DIES

In threading a lot of screws that had to be very accurate, it was found that the ordinary die-holder was not satisfactory. The screw threads were required to have a high finish, and for this reason two dies were employed, one for roughing 75 per cent of the full thread depth, and the other for sizing. Unfortunately, when the roughing die was adjusted, it had a tendency to cut a thin thread. This trouble was finally traced to the uneven expanding action, which caused the two sides to spring out of alignment, as shown in the view at *A* in the accompanying illustration. This misalignment was so slight in most cases that it was not easily detected, but nevertheless it had a very detrimental effect on the thread form and the pitch accuracy.

The die-holder shown in the illustration served to remedy the trouble. The threaded cap *B* of the holder is bored out to a depth slightly less than the thickness of the die. The die is placed in the cap and adjusted in the usual manner by screws in the tapped holes in the cap. Cap *B* is screwed on the holder *C*. Thus the die is held securely in place between the faces *D* and *E* of the cap and shank, respectively, and there is no possible chance for the die to twist. The grip on the dies retained in this holder proved sufficient to permit dies to be used that had previously been discarded because of breakage across the spring section.

London, England ROBERT JULIAN



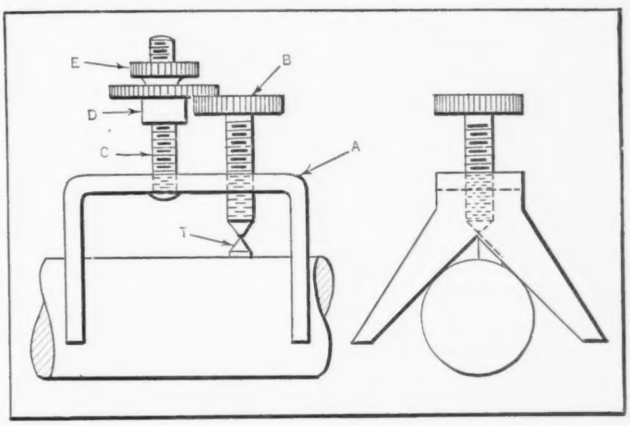
Holder for Threading Dies

GAGE FOR SETTING THREADING TOOL

The gage shown in the accompanying illustration was made primarily for use in setting the tool *T* for internal threading operations on the lathe when the work is stationary and the bar that holds the threading tool revolves. The gage can also be used to advantage in setting the tool for threading operations on milling machines, radial drills, and floor type boring machines.

Referring to the illustration, *A* is a steel body having forked ends which serve as V-blocks to locate the device in a position parallel with the axis of the boring-bar. The accurately threaded stud *C* is securely fixed in body *A*. The thumb-screw *B*, which has a conical end terminating in a land about 1/6 inch in diameter, is carefully threaded to fit the threaded hole in member *A*. On stud *C* is the thumb-nut *D* and the lock-nut *E*. For clarity these nuts are not shown in the end view.

In cutting an internal thread, the tool bit *T* is first set in the boring-bar so that it just skims the surface of the hole to be threaded. The gage is then placed on the boring-bar and adjusted so that



Gage for Setting Internal Threading Tool

the land on the end of screw *B* just touches the point of the threading tool. Thumb-nut *D* is then run out an amount equal to the finished depth of the thread, and locked in this position by means of lock-nut *E*. The setting of nut *D* is accomplished by measuring the distance from the under side of the head on screw *B* to the upper side of the flange on nut *D*. By making the thumb-nut flange 3/16 inch thick and the head of the thumb-screw 5/16 inch thick, the sum is 1/2 inch, which is a convenient dimension to add to the depth of the thread in determining the micrometer measurement.

The tool bit is extended the required depth for each cut, the amount being determined by backing out the thumb-screw *B* and using the gage for setting the tool for each cut. The threading tool bit is pushed back to clear the work while being returned to the starting position. The resetting of the tool for each cut is not such a tiresome job as might be imagined. The threading cuts are taken as described until the setting of the thumb-screw *B* is such that the top surface makes contact with the under side of the flange on nut *D*. When this position has been reached, the device indicates that the thread has been cut to its full depth.

Willimantic, Conn. H. A. FREEMAN

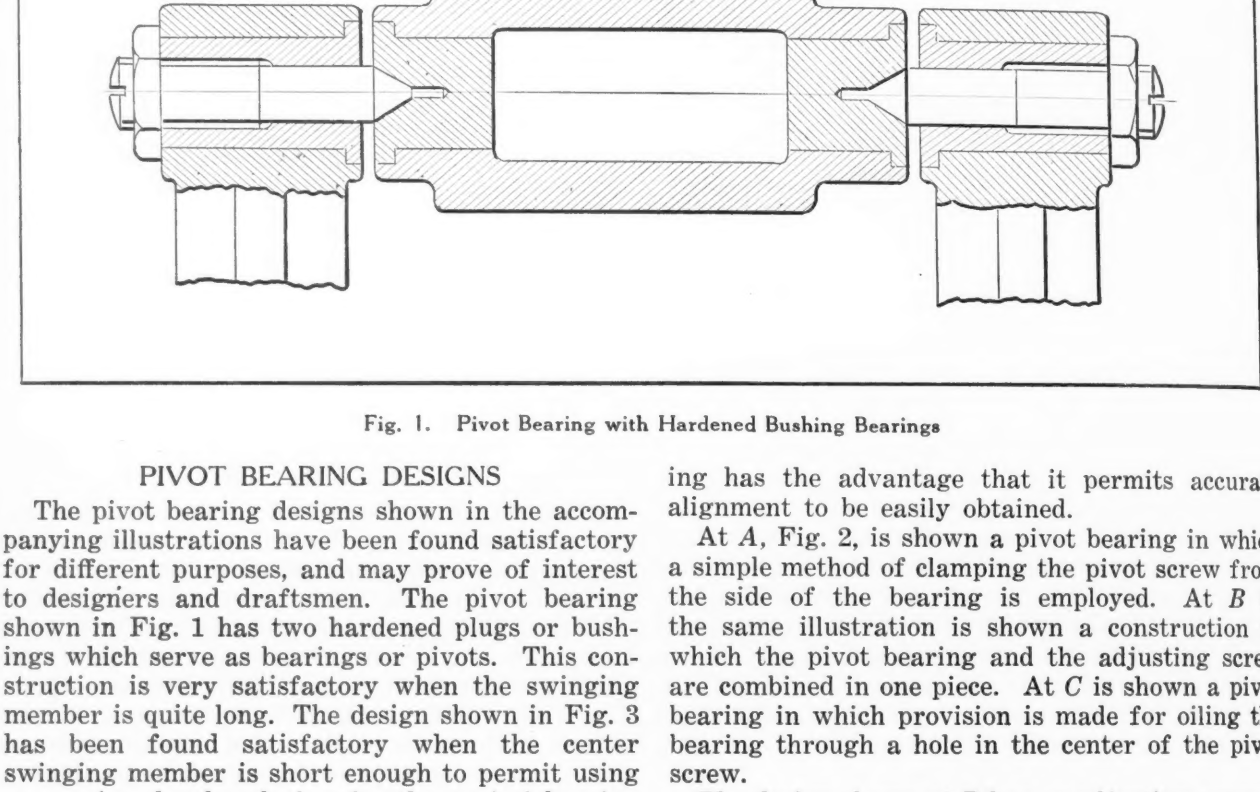


Fig. 1. Pivot Bearing with Hardened Bushing Bearings

PIVOT BEARING DESIGNS

The pivot bearing designs shown in the accompanying illustrations have been found satisfactory for different purposes, and may prove of interest to designers and draftsmen. The pivot bearing shown in Fig. 1 has two hardened plugs or bushings which serve as bearings or pivots. This construction is very satisfactory when the swinging member is quite long. The design shown in Fig. 3 has been found satisfactory when the center swinging member is short enough to permit using a one-piece hardened plug for the conical bearing points of the pivots. The one-piece central bearing has the advantage that it permits accurate alignment to be easily obtained.

At *A*, Fig. 2, is shown a pivot bearing in which a simple method of clamping the pivot screw from the side of the bearing is employed. At *B* in the same illustration is shown a construction in which the pivot bearing and the adjusting screw are combined in one piece. At *C* is shown a pivot bearing in which provision is made for oiling the bearing through a hole in the center of the pivot screw.

The design shown at *D* has an adjusting screw *G* which is separate from the pivot bearing *H*. Pivot

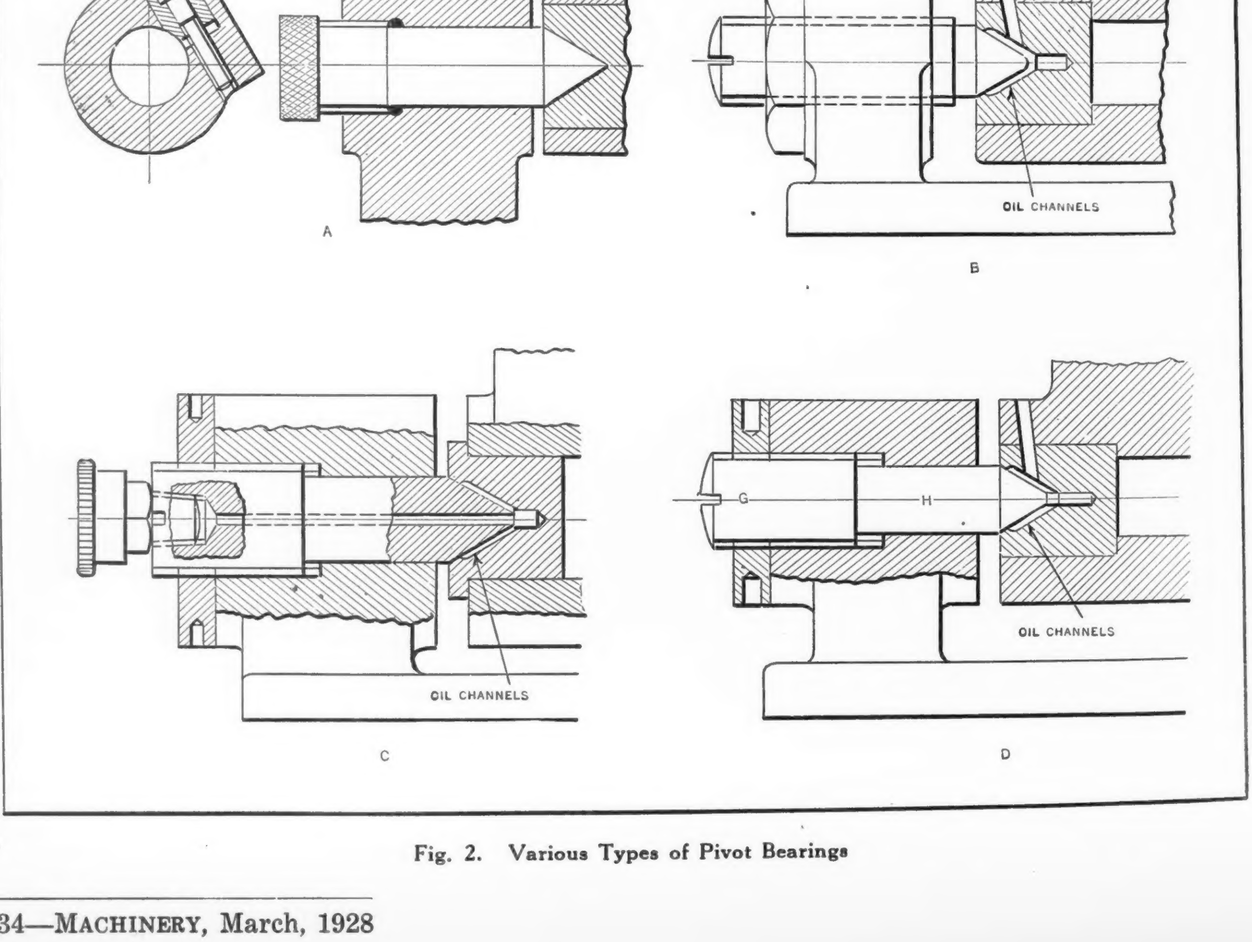


Fig. 2. Various Types of Pivot Bearings

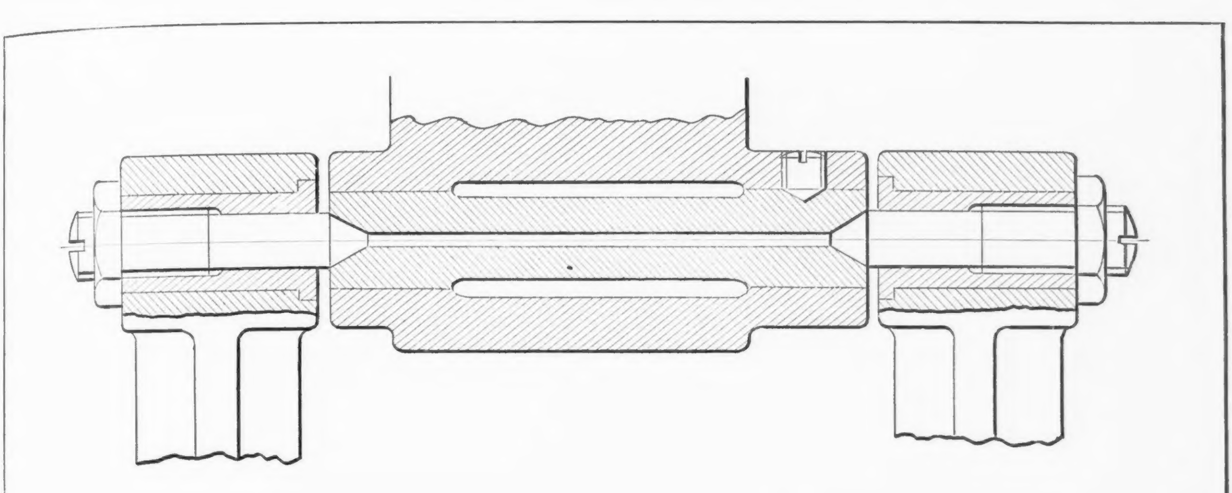


Fig. 3. Pivot Bearing with One-piece Hardened Bushing or Plug

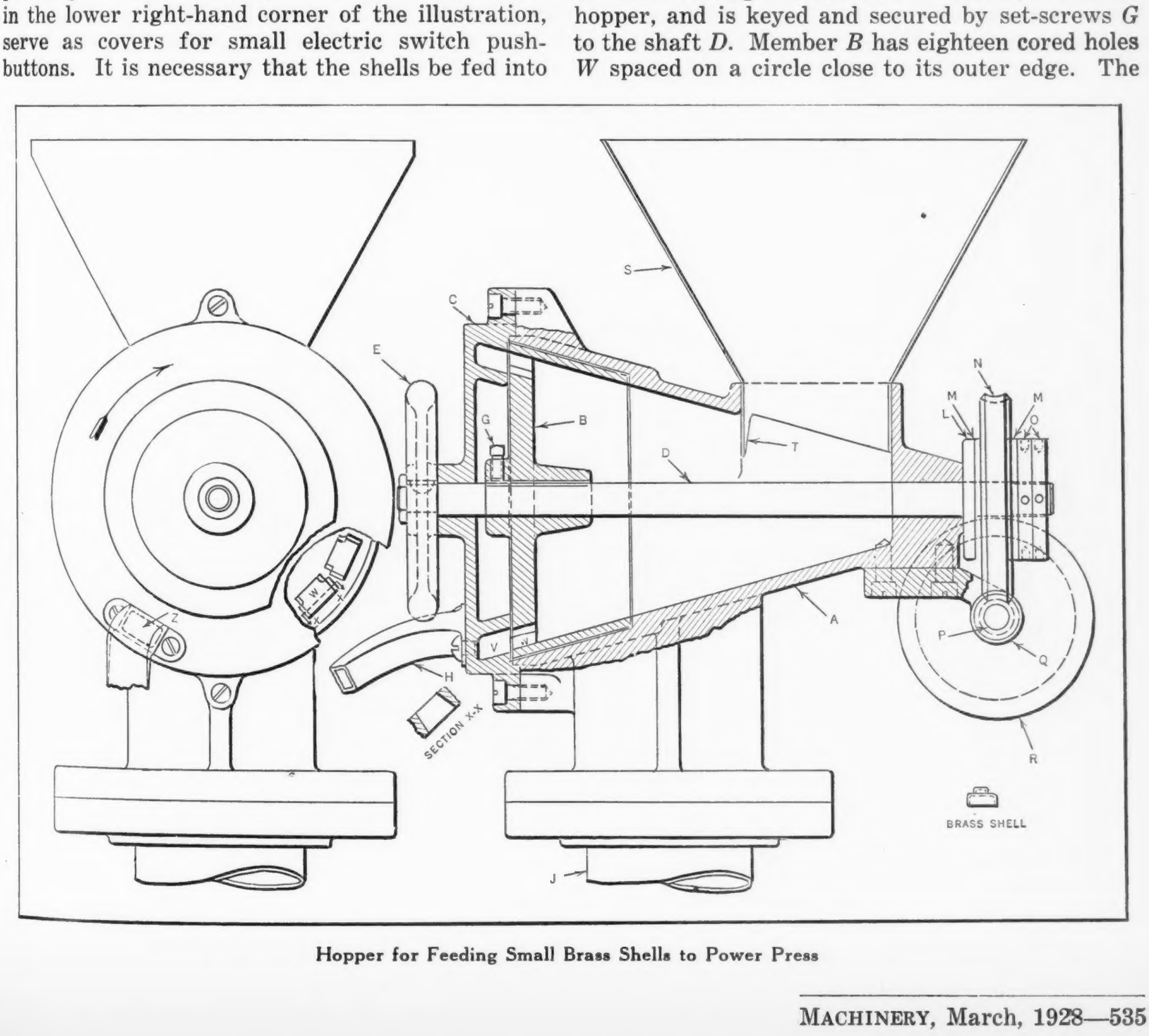
bearings of this type are used to a considerable extent on high-precision machines, and have been employed successfully on profiling machines. This type of bearing can be very easily adjusted.

Rochester, N. Y. EDWARD T. HEARD

HOPPER FOR FEEDING DIAL POWER PRESS

The accompanying illustration shows a hopper for automatically feeding brass shells to a dial power press. The shells, one of which is shown in the lower right-hand corner of the illustration, serve as covers for small electric switch push-buttons. It is necessary that the shells be fed into the dial power press with the small closed end at the bottom, so that a 3/16-inch hole can be pierced in the end. The hopper member *A* is bolted to a pedestal consisting of a length of pipe *J* with a standard pipe flange screwed on each end. The flange at the lower end is secured to the floor with lag screws, while the top flange is bolted to the base of the hopper.

The hopper *A* is conical in shape, and is cored out at the upper side to receive the auxiliary hopper *S*. The rotating member *B* is a clearance fit in the hopper, and is keyed and secured by set-screws *G* to the shaft *D*. Member *B* has eighteen cored holes *W* spaced on a circle close to its outer edge. The



Hopper for Feeding Small Brass Shells to Power Press

bottom of each cored hole is flush with the inside surface of the cone chamber, and the shape of the holes is such that the shells can pass through freely when the larger portion is at the bottom.

The cover *C* is secured to the stationary hopper *A* and carries the bearing for the shaft *D*. An angular groove *V* is cut in the cover. The opening, as shown by the cross-section *X-X*, is sufficient to accommodate one shell at a time. A handwheel *E* is keyed and fastened to shaft *D*. Shaft *D* is revolved by means of the worm-gear drive at the rear end of the hopper. The worm *Q* is cut integral with the shaft *P* on which is fastened the grooved pulley *R*. Pulley *R* is driven by a belt from the countershaft.

The worm-gear *N* is a slip fit on the shaft, and imparts motion to the shaft through frictional contact with the fiber washers *M*, the shoulder *L* of the shaft, and the adjustable spanner wrench nuts *O*. This construction permits shaft *D* to be turned by means of handwheel *E*.

The auxiliary hopper *S*, which is made of heavy sheet metal, is provided with a baffle plate *T* to limit the flow of shells. If it were not for this baffle plate, the conical hopper would become filled completely, and would not function properly. The brass chute *H* is fastened to the cover plate *C* over the hole *Z*. The opening in this chute is made large enough to allow the shells to pass through without difficulty.

It will be noted that the hole in the cover through which the shells pass to the chute *H* is set at an angle. After much experimenting, it was found that with the hole located in the angular position, a larger quantity of shells would be delivered per minute. The end of the chute is given a half twist to correct the position of the shells before they reach the press dial.

It might be of interest to note here that the brass tubing from which the chute is made can be purchased in practically any size and shape desired. This tubing can be bent to suit requirements by filling it with melted rosin. After the rosin has become cool, the tubing can be bent by the aid of a bench vise and suitable wrenches.

In operation, the shells roll down the inside of the cone and on the revolving member *B*. When a shell arrives in the proper position it will, due to gravity and the action of the shells following it, pass through one of the holes *W* and into the groove *V*, which is stationary. When a sufficient number of shells has entered this groove, they will pass through the ejecting hole *Z* and down the chute. In this type of hopper, no overflow is necessary, as the shells cannot enter the holes *W* unless the groove *V* is partially empty.

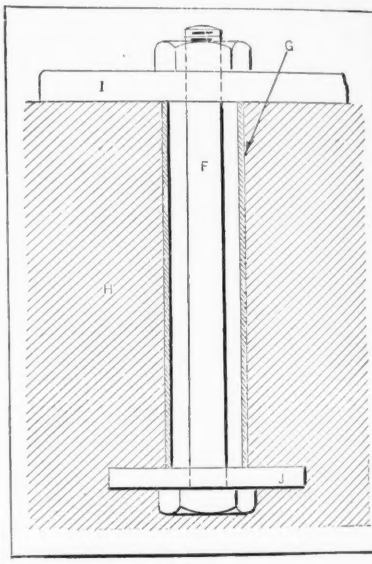
In case of jamming, the part can be released by a slight turn of the handwheel *E*. Sight-holes are provided along the top of the tube *H* to permit the flow of shells to be inspected. Equipping the press with the feeder described made it possible to increase the speed of the press from 100 to 120 strokes per minute, and enabled one man to keep three machines in operation, whereas previous to the installation of the feeding device, one man was required for each press.

Bridgeport, Conn. J. E. Fenno

ANCHOR BOLTS FOR HEAVY MACHINERY

Heavy machines such as stationary engines, for instance, are often provided with a separate concrete foundation to which they are fastened by bolts embedded in the concrete when it is poured. Often a machine bed must be prepared before the machine has arrived. In such cases, the positions of the bolts set in the concrete are determined from blueprint plans. When the machine is on hand, the positions of the bolts can be determined by measurements taken directly from the machine. In any case, it is somewhat difficult to place the bolts in exact alignment with the holes in the machine base.

In the accompanying illustration is shown a practical method of placing the bolts in the foundation in such a way that they can be sprung sufficiently to bring them into alignment with the bolt holes in the machine base. This is accomplished by placing a tin tube or pipe *G* around the bolts, as indicated in the illustration. This tube is made an inch or more larger in diameter than the bolt. Tubing of this kind is often carried in stock by the tinsmith.



Anchor Bolt for Securing Heavy Machine to Concrete Floor

If the bolts are exceptionally long, the tube need not run the full length of the bolt. As the tube is not removed, it may be filled with mortar just before the machine is bolted down. Referring to the illustration, *J* is the anchor block, *I* the flange on the machine or engine base, *H* the concrete base, *G* the tube, and *F* the anchor or foundation bolt. Any bolt that is not in line may be bent or forced into alignment by means of a small wooden wedge driven into the tubing at one side of the bolt. After the bolt has been wedged or forced over into position in this manner, the tube may be filled in with mortar, which will harden after the machine has been bolted down. This method of obtaining alignment has proved very satisfactory.

Lewisburg, Pa. C. A. Martyn

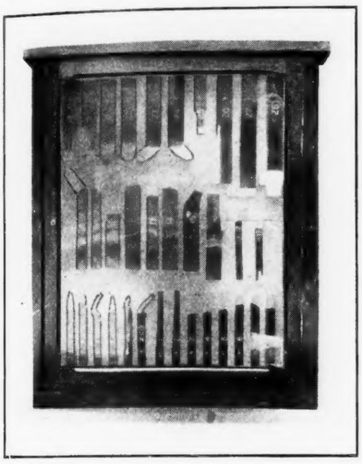
* * *

In an address made by Alfred P. Sloan, Jr., president of the General Motors Corporation, the fact was emphasized that the success of any great undertaking requires an analysis of the facts with an open mind, and that there is only one way in which anything worth while can be accomplished—that is, by hard work. "In my opinion," said Mr. Sloan, "without hard work nothing real can be accomplished. It sometimes seems—everyone has seen such cases—that results are accomplished without hard work, but I think that in the long run this will not work out. There is no short-cut."

Shop and Drafting-room Kinks

MODEL TOOLS IN CASE

In the Atchison, Topeka & Santa Fé Shops at San Bernardino, there are three duplicate cabinets of tool models. One cabinet is kept at the tool-room window, one at the tool dresser's fire in the blacksmith's shop, and one in the machine shop. These models (see illustration) are tools used on the boring mill, lathe and shaper. There are also some special tools for use on the quartering machine and horizontal boring machine. The models are all numbered, as it is much simpler for workmen to go to the tool-room window and call for, say, a No. 6 style of given size, than it is to attempt to describe the tool. The models are ground out of wood, painted black on the body, and silver color on the cutting end.

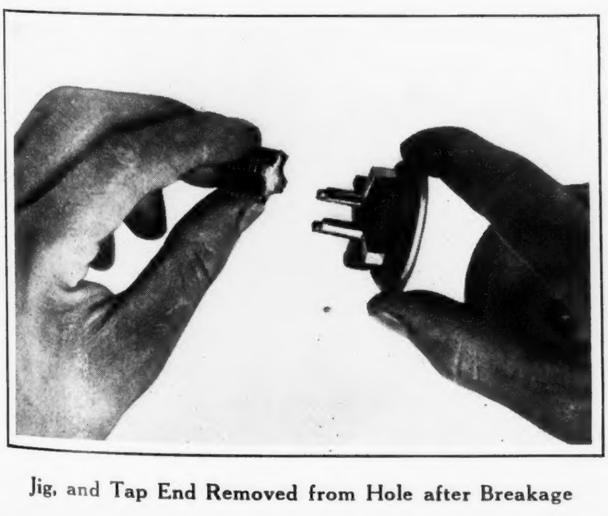


Case Containing Numbered Tool Models

San Bernardino, Cal. J. R. PHELPS

SIMPLE JIG FOR REMOVING BROKEN TAP END

An excellent and easily made jig for removing broken tap ends can be made of an old cast-steel air or gas valve, by sawing the wings, as shown in the illustration, leaving four rigid prongs which can be pushed down into the flutes of the broken end. The center of the valve where the wings intersect is sawed out no wider than the bottom of the flutes. Right-angle cuts with a hacksaw dress out the prongs so that they will fit the flutes. This can be quickly done, by using the threads of the handle end of the tap as a guide for size.



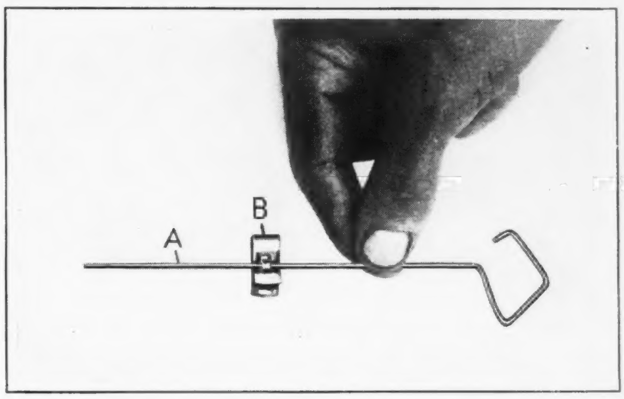
Jig, and Tap End Removed from Hole after Breakage

Where a tap breaks off some distance below the face of the metal, the method described will be found practical. It is seldom possible to get at the broken end with anything rigid enough to stand the slight twist necessary to back it out. The tap can be loosened considerably by tapping the top end with a punch. Old wing valves are not difficult to obtain, and can be quickly made into an efficient tool as described.

Missouri Valley, Iowa FRANK W. BENTLEY, JR.

IMPROVISED DEPTH GAGE

A very handy and easily made depth gage can be constructed by bending a piece of wire *A*, as shown in the illustration, and slipping over this wire a spring brass wire connector *B* removed from an old dry battery. The connector grips the wire firmly and squarely, yet it can be easily set to gage the depth by slipping it along the wire. This improvised gage is particularly useful for gaging the depths of small holes or openings in which larger gages cannot be used. F. B.



Bent Wire and Battery Clip Used as Depth Gage

HARDENING LONG SLENDER TOOLS

The writer has used a method of hardening long round tools, such as twin reamers, taps, etc., for many years, which has not, to his knowledge, been described in any publication. The method gives good results and will doubtless be of interest to many readers.

The tools to be hardened are heated in the usual way, but instead of being gripped with a pair of tongs and plunged into a quenching liquid, the shank end of the tool is gripped in the chuck of an electric drill and revolved at full speed while being plunged into the quenching liquid. The tool is revolved continuously until it has become entirely cool. This method seems to prevent the tools from warping, and has been used with very good results in hardening broaches. The writer has been informed that the axles made by a well-known automobile manufacturer are hardened in a manner similar to that described.

Philadelphia, Pa. CHARLES KUGLER

Questions and Answers

RATING OF FORGING HAMMERS

T. O.—In power hammers, such as air and steam hammers and drop-hammers, what is generally meant by a 1/2-ton or a 1-ton hammer?

Answered by Chambersburg Engineering Co., Chambersburg, Pa.

All forging hammers are rated in terms of the total weight of the falling or reciprocating parts. This weight includes the ram, rod, rings, and ram die with its key and dowel. In drop-hammers, both steam and air, the rating is based on the total falling weight of the ram, rod, and rings. The dies are not included in this type.

The rating of board drop-hammers is based on the total weight of the ram, boards, and the wedges which hold the boards in place in the ram. In this type, as in the other drop-hammers, the weight of the dies is omitted from the rating calculation.

Therefore, a 1/2-ton hammer and a 1-ton hammer will be interpreted by a hammer manufacturer as meaning hammers having 1000 and 2000 pounds falling weight, respectively. The rating of hammers does not refer to the energy available, since varying speed, stroke, and steam conditions, as well as the ratio of anvil weight to falling weight, modify the ability to produce work.

PREVENTING THE RUSTING OF CASTINGS PREPARED FOR SHERARDIZING

T. C.—How can rust be prevented from appearing on castings that have been pickled and washed in preparation for sherardizing? The rust appears immediately after drying, and renders the sherardizing process difficult.

Answered by A. E.

Sherardizing, like other zinc-coating processes, requires a clean surface free from rust or scale. To prevent rusting after cleaning with acid by pickling, the castings should be placed in a boiling solution of cyanide, allowing 5 to 6 pounds of cyanide crystals to 100 gallons of water. This generally assures a bright coating.

If the castings are cleaned by sand-blasting, there is no danger of rusting. If sand-blasting cannot be done, proper pickling and after-treatment are necessary before placing the castings in the sherardizing drum containing the zinc dust. The temperature at which the sherardizing furnace is maintained varies from 500 to 700 degrees F., according to the size of the castings coated.

One of the best pickling baths for cleaning iron or steel castings consists of 10 per cent each of hydrofluoric acid and sulphuric acid, with 80 per cent water. The acids should be separately diluted before being added to the bath. Sometimes a diluted sulphuric acid bath is also used for iron castings. In preparing this pickling bath, the acid should be poured into the water while the latter is being stirred, and in no case should the water be added to the acid.

After pickling with hydrofluoric or sulphuric acid, the castings should be immersed and washed in water, followed by an immersion in a soda solution to neutralize any remaining traces of acid.

After being thoroughly cleansed, the castings should be immediately transferred to a tank of clear water to prevent oxidation. No time should be lost in this operation, as iron castings are readily susceptible to rust. The castings may be put in the drum while wet just as they come from the water tank.

Another method of preventing rust after the castings have been pickled, washed, and immersed in the alkaline solution is to dry them rapidly, preferably in a gas-heated oven, and then go over them thoroughly with a steel brush. The castings should next be dipped in petroleum oil or, as an alternative, smeared with petroleum jelly that is free from mineral acid. When the sherardizing equipment is ready for coating the castings with commercial zinc dust, the temporary protective oil coating should be removed, although it has been found that where no fats are used with the oil and the zinc dust is new and of sufficient metallic strength to force itself through the oil, the castings can be sherardized without removing the oil. When this method is used, the zinc coating is much darker in color.

Answered by Cotan

Apparently the difficulty experienced is due to the fact that the oxidizing effect of the acid pickling bath is not properly neutralized. The difficulty may possibly be overcome by employing the following baths: First clean the castings by pickling in a sulphuric acid or hydrofluoric acid bath. The sulphuric acid bath is formed by pouring one part of acid into six parts of water, and the hydrofluoric acid bath by mixing one part of acid with fifteen parts of water. This will remove all scale, sand, and most of the rust. The sulphuric acid, however, attacks the iron vigorously, so that articles should not be left in the bath longer than is absolutely necessary.

When removed, the articles should be well washed in cold water, preferably under force. If after this, the articles are dipped in a hydrofluoric acid bath, any trace of rust which may have been left by the sulphuric acid bath will be removed or the formation of rust will be prevented during the drying by the formation of a thin layer of iron chloride on the castings. The hydrofluoric acid bath should contain one part of acid to two parts of water.

* * *

British machine tool production and exports were practically the same in 1927 as in the two previous years. The American share of the total imports was about 65 per cent. American sales consisted largely of milling and grinding machinery, gear-cutting machines, honing machines, and crankshaft balancing machines.

The World's Most Modern Steel Mill

The New Ford Steel Mill is Considered the Last Word in Design

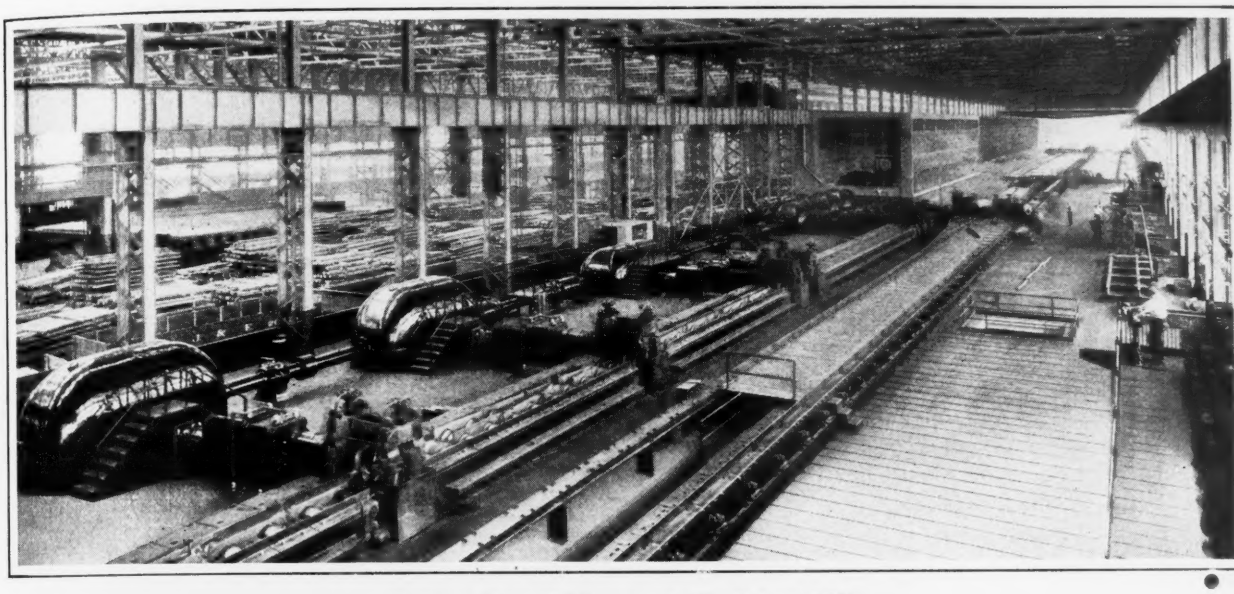


Fig. 1. General View in the Ford Steel Mill

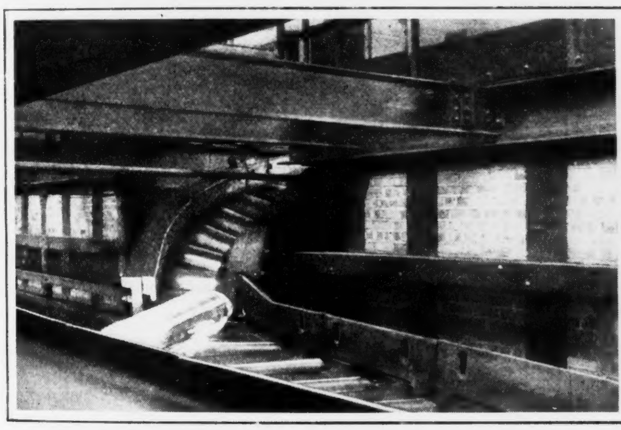


Fig. 2. Conveyors Carry Ingot from Soaking Pit to Rolls

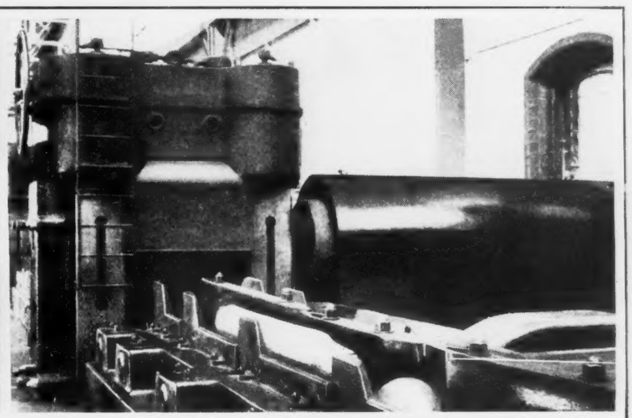
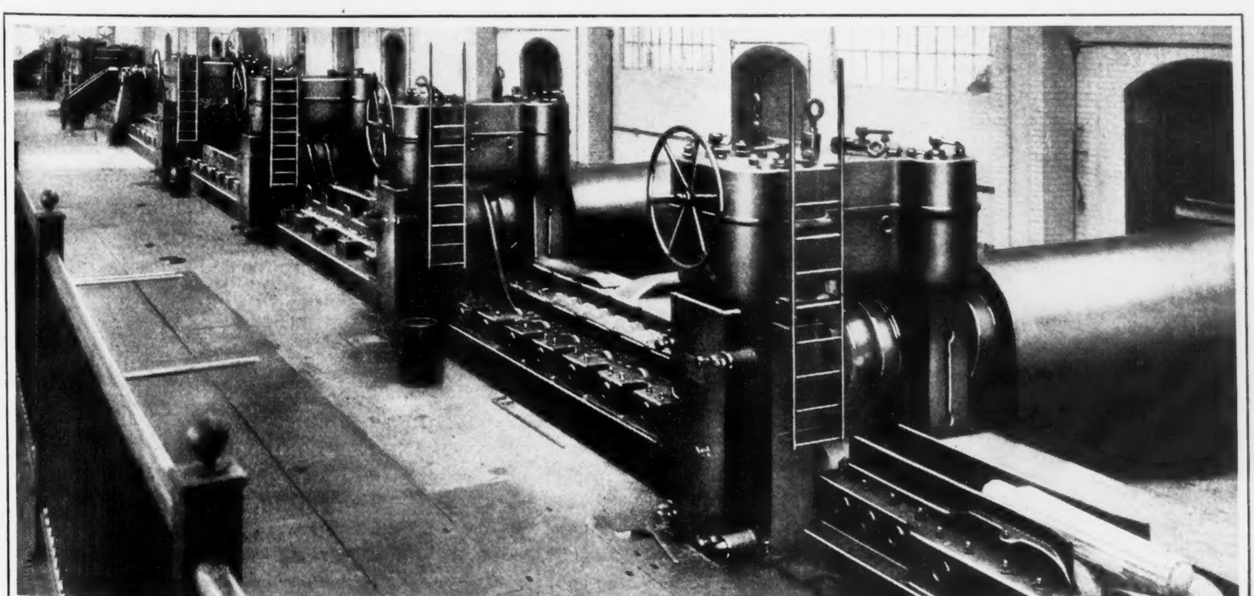


Fig. 3. Close-up View of a 42-inch Mill



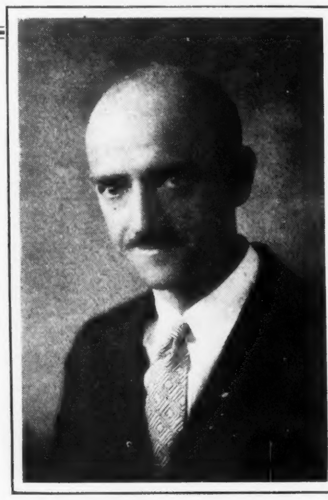
Photographs by Courtesy of The American Gas Association

Fig. 4. The Continuous Mill with Ingot Just Passing into the First Pair of Rolls

Accurate Graduating in Mount Wilson Shop

Machine for Ruling Diffraction Gratings Having 15,240 Equidistant Lines per Inch

By JOHN HOMEWOOD



WHEN astronomers or physicists want to ascertain the chemical characteristics of the sun or other stellar bodies, they make use of a spectroscope, in which the light emitted by the luminous body is separated into components that reveal the nature of the substance. Some spectroscopes have a train of prisms through which the light passes to produce the spectra, but when great "resolving power" and accuracy is required, the spectroscope is equipped with a diffraction grating, which is a highly polished metal or glass plate, having on its surface extremely fine equidistant parallel lines which serve to produce spectra by diffraction.

This part of a spectroscope is interesting to the mechanic because it represents the "last word" in accurate graduating. Some gratings have 30,000 or even 40,000 lines per inch, but a smaller number generally is employed. The gratings which are graduated by the machine to be described have 15,240 lines per inch, and as they must be extremely accurate as to spacing and parallelism, it is evident that the graduating machine represents a high degree of precision. It also embodies many interesting mechanical features, because the extreme accuracy obtainable depends upon the design or method, as well as upon the accuracy of the elements forming the machine.

Speculum metal, which consists of 68.3 per cent copper and 31.7 per cent tin, is considered the best material for diffraction gratings. The lines on one of these graduated plates are so fine that they cannot be seen with the naked eye. Although the distance between adjacent lines is only 1/15,240 inch, an inaccuracy in parallelism resulting in the meeting of the lines if they could be extended 300 miles would be too great. Moreover, the uniformity of spacing must be such that the error will not equal 1/100 of the distance between adjacent lines. The graduating machine used for this extremely fine work (see illustration) was designed and constructed in the Mount Wilson Laboratory shop in Pasadena, Cal., and it is located in a constant-temperature chamber beneath one of the buildings.

In the operation of this machine, a diamond graduating tool is traversed across the highly polished plate or grating a distance which may be varied according to the desired length of the lines. During the return stroke, the diamond is lifted to provide clearance, and the carriage supporting the plate is indexed 1/15,240 inch. The next successive line is then ruled, this cycle being repeated automatically. When the machine is in operation, the operator is not permitted to be in the room, because errors would result from the temperature of his body.

How the Diamond Graduating Tool is Held and Traversed

The diamond tool is held by a support at *A* on slide *B*, which is traversed along hardened, ground, and lapped ways *D*. The traversing movement is obtained from a crank which is adjusted to give the required stroke. The rod on this crank connects indirectly with the diamond-holder slide through a sub-slide and four parallel tension springs. These springs are centrally located between the ways; two are for the forward stroke, while the other two are for the return stroke. The transmission in each case is by spring tension, and as the pairs of springs are centrally located one above the other, a flexible connection is obtained that eliminates any possibility of side pressure upon the ways; consequently, the slide is guided by these accurate ways, and minute errors which might result from lack of alignment or vibration of the driving mechanism are not transmitted through the spring connection.

The diamond tool-holder is supported by two hardened and ground taper trunnions, and it is oscillated by a cam (not shown) on the main driving shaft, which transmits motion through rod *G*. The diamond is ground to an angle of about 120 degrees, and it is counterweighted so that the weight on the plate being graduated is about 1/3 dram.

Obtaining an Indexing Movement of 1/15,240 Inch

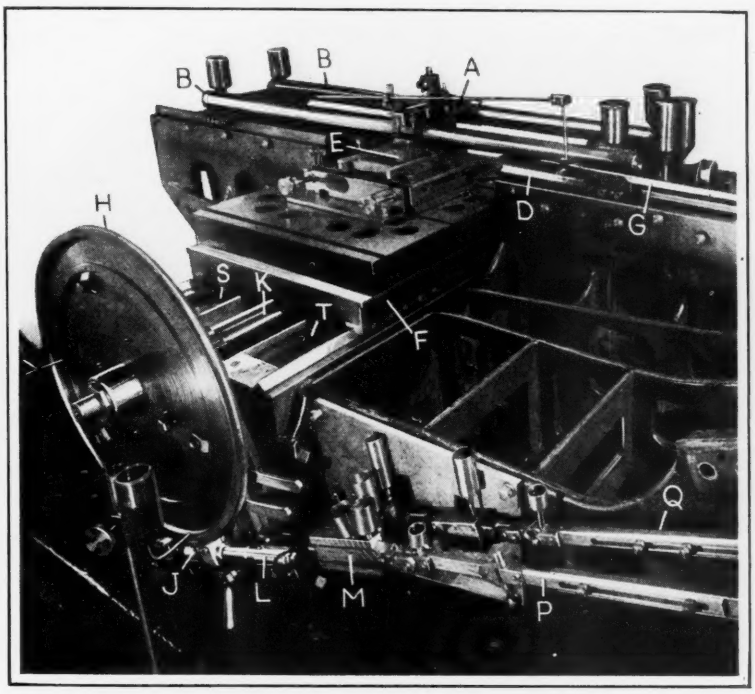
The grating *E* to be graduated is supported by a heavy carriage *F*, which is indexed as screw *K* is turned exactly 1/1200 revolution, or the angular equivalent of 18 minutes, after each line is drawn. To obtain this precise rotation of screw *K*, there is a worm-wheel *H* having 1200 teeth, a worm *J*, and a cam *L*. The cam is engaged by a pin on slide *M* which is reciprocated by rod *P* and a crank. One stroke of slide *M* rotates the cam and worm exactly one revolution; then an angular

JOHN HOMEWOOD, who for the last five years has been an instructor of engineering drawing and elementary machine design at the Chaffey Union High School and the Chaffey Junior College, Ontario, Cal., is a graduate of the University of California. He served an apprenticeship with the American Bridge Co., Ambridge, Pa., and later worked several years as an all-around machinist and toolmaker. While in the employ of the American Multigraph Co., Cleveland, Ohio, as toolmaker, he was promoted to tool designer and checker in the engineering department. Later he became assistant to the works engineer of the Chicago Pneumatic Tool Co. at the company's Franklin, Pa., plant, and still later chief draftsman and field engineer for the Barouth Machine & Tool Co., Toledo, Ohio. During the war he superintended the installation of machinery and supervised the design of tool equipment for shells, later taking charge of production.

auxiliary slide, operated by another crank acting through rod Q, withdraws slide M and its pin to clear the cam during the return stroke. After the pin and slide are again in the working position, they move forward and make contact with the cam at the original starting point, so that each indexing stroke results in an angular movement of 360 degrees.

Screw K has a lead of 2 millimeters (12.7 threads per inch); hence, one revolution of the single-threaded worm gives the indexing movement required.

The crank disk for driving rods P and Q connects indirectly with the main driving pulley. This pulley has three equally spaced driving pins near its outer edge, which connect with corresponding pins on the crank disk by rubber bands, so that vibration from the 1/2-inch round rubber belt will not be transmitted.



Extremely Accurate Machine Used in Graduating Diffraction Gratings which have 15,240 Lines per Inch

The lead-screw was cut in a precision lathe. Great precaution was taken to duplicate minute local errors throughout the screw length so that they could be removed more readily by the final lapping process. To obtain a uniform distribution of such errors, the relative position of the lead-screw gears was changed one tooth between successive finishing cuts. The lap used in finishing the screw is in the form of a long nut split longitudinally. This internally threaded lap was counterweighted to avoid sagging of the screw due to its weight, and was traversed across the screw a great many times. Oil and jeweler's rouge was used as an abrasive, and by reversing the lap periodically a screw of extreme accuracy as to *uniformity* of lead was obtained.

Cross-slide which Floats in Mercury

The cross-slide or carriage F weighs approximately 700 pounds when fitted for the largest grating (18- by 24-inch size) within the capacity of this machine. If this heavy slide were entirely supported on ways, the frictional resistance and resulting load on the indexing mechanism would make it impossible to obtain the required accuracy. To obtain freedom of movement and avoid stressing of parts so as to cause appreciable flexure, the carriage is almost entirely floated in a mercury bath. This mercury is located in the channels S and T, and projections on the under side of the carriage extend down into the mercury, thus displacing an amount almost equal to the carriage weight. The specific gravity of mercury is 13.58 (at 60 degrees F.), whereas the specific gravity of cast iron is 7.20; hence, the carriage might be floated entirely in the mercury bath, but the displacement of mercury is reduced so that the hardened and ground ways support about 10 pounds, or enough to insure accurate alignment without introducing a serious friction load.

Special Thrust Bearings and Other Constructional Features

The thrust of the screw is received by a hardened and ground flat steel bearing in contact with a constructed ruby 3/16 inch thick and 3/8 inch in diameter. This thrust bearing has a load of about 23 pounds. The constructed ruby was found, after extensive tests, to be more durable than either sapphire or genuine ruby, and tests with tungsten carboloy are being conducted at present. The thrust of the Hindley worm J is also taken by a constructed ruby bearing. The main feed-nut attached to the carriage is about 9 inches long and imparts motion to it through a thrust plate having universal adjustment. The shoes for slide B are of special metal having a low coefficient of friction and of expansion. These shoes are semi-rigid, one side being held against the rail by spring pressure.

The machine is insulated from the driving pulley and rests upon a mattress 10 inches thick consisting of cork and rubber. This mattress, in turn, is supported on a foundation 4 feet thick, which does not make contact with the building foundation. The whole machine is encased within a glass enclosure in a vault thermostatically controlled for a temperature of 70 degrees F. The chamber is locked while the machine is at work, and the operator does not enter until the graduating is entirely finished. This machine will rule at the rate of 6 feet of line a minute, and three or four days are required for ruling a grating.

The writer is greatly indebted to Dr. Adams, Dr. Anderson and Mr. Clement Jacomini of the Observatory Laboratory staff for assistance in obtaining information for this article.

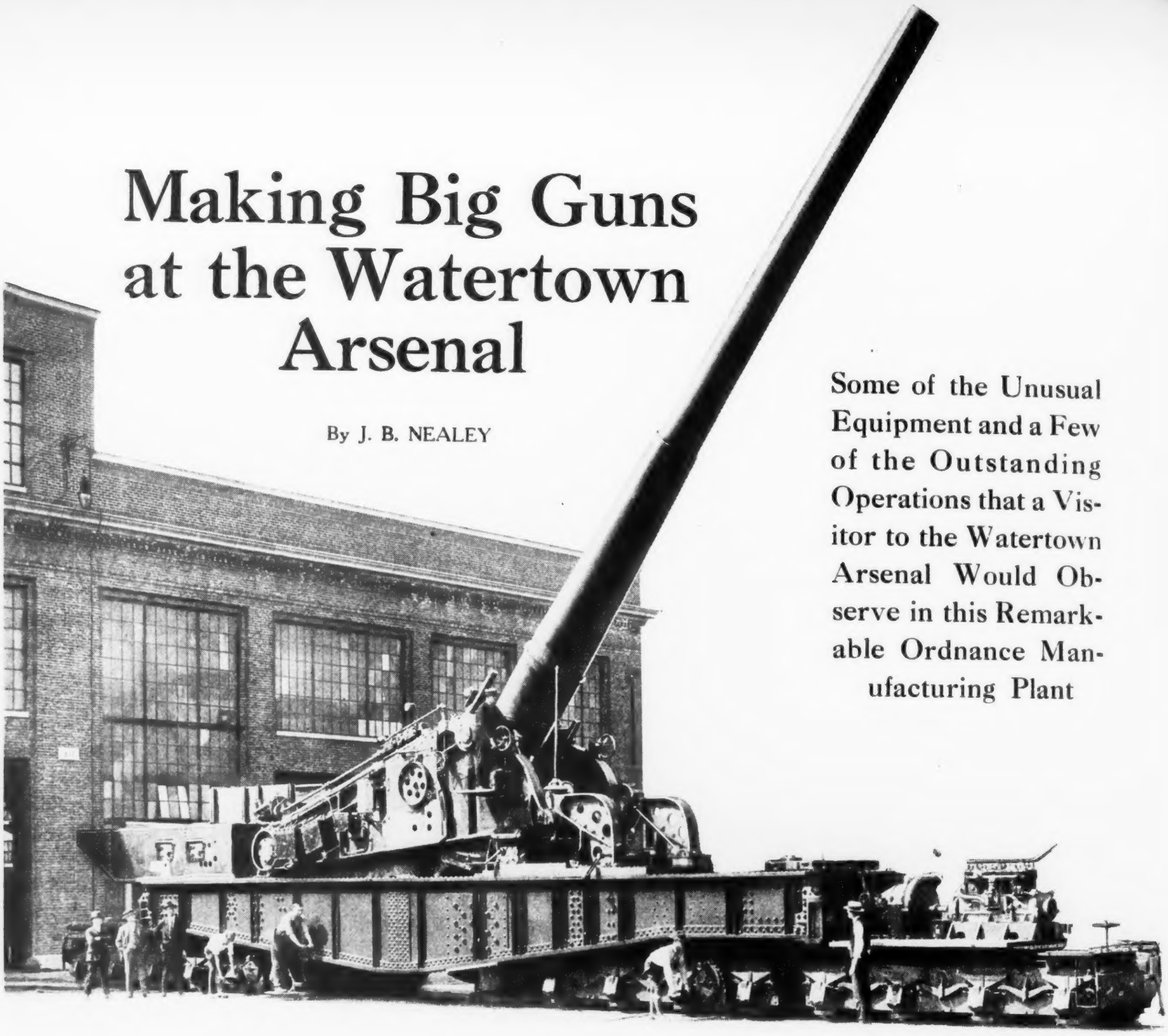
* * *

The exports of industrial machinery during 1927 were the largest since 1921. They reached a total value of $180,000,000, as compared with $157,000,000 in 1926, showing a gain of 15 per cent. Metal-working machinery was exported to a value of $25,400,000 as compared with $18,900,000 in 1926.

Making Big Guns at the Watertown Arsenal

By J. B. NEALEY

Some of the Unusual Equipment and a Few of the Outstanding Operations that a Visitor to the Watertown Arsenal Would Observe in this Remarkable Ordnance Manufacturing Plant



THE Watertown Arsenal at Watertown, Mass., is self-contained, from pig iron to the finished product. While in peace time this immense plant is not operated to capacity, its research department is going full speed, and many new types and designs of guns, especially of the anti-aircraft and coast defense type, are being made under its supervision. Through its activities, many new and far-reaching discoveries have been made in recent years.

Guns ranging in size from 1 1/2 inches (37 millimeters) to 9 1/2 inches (240 millimeters) are manufactured, starting with the making of the steel, for which three large open-hearth furnaces with all the necessary auxiliary equipment are provided. The forge shop is housed in a building 1000 feet long, containing batteries of steam hammers and forging presses, as well as a rolling mill, soaking pits, and auxiliary equipment. The forgings for guns, shells, gun carriages, and gun cradles of every size and description are produced here. Carriages for guns up to 16 inches are made in this plant.

Briefly, the procedure in making a gun tube, liner, and jacket is as follows: After the forging is completed, it is annealed and then rough-machined to approximate dimensions. The parts are then heat-treated, tested for physical properties, and finish-machined. The rifling of the liners, the insertion in the tubes and the shrinking on of the jackets is done at the Watervliet Arsenal. For the performance of the machining operations, two large well equipped machine shops are maintained at the Watertown plant.

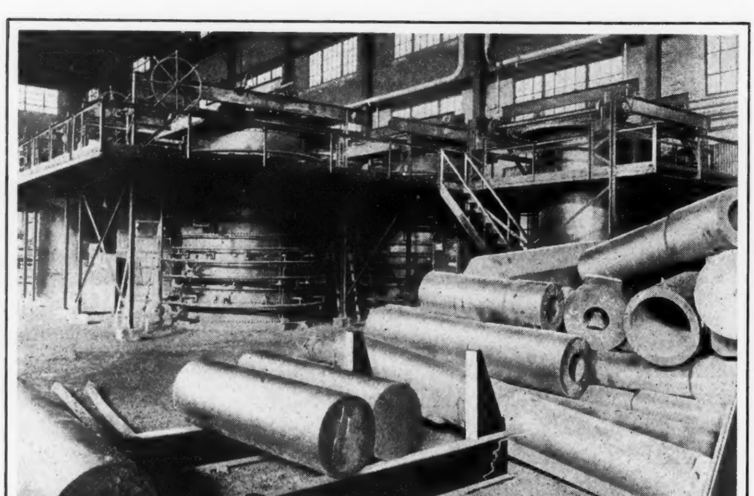


Fig. 1. Battery of Heat-treating Furnaces and Quenching Tanks with Forgings Ready for Heat-treatment

Heat-treatment of Gun Forgings

The heat-treating of the big gun forgings constitutes one of the major operations. For this work, large cylindrical, vertical furnaces, set in pits, rise about 20 feet above the floor level of the heat-treating building, which is served with spur tracks and overhead traveling cranes, so that the guns can be run in on cars, elevated above the tops of

the furnaces, and lowered into them rapidly, in a vertical position, by mechanical means.

Fourteen of these heat-treating furnaces are provided, nine of which utilize gas as a fuel. They are used for heating the forgings for hardening and for drawing the temper, and are arranged in two groups, each group centered around a quenching tank. A gallery is built around the top of each group to facilitate charging and discharging and to afford the operators access to the furnaces. The furnaces are, on an average, 7 1/2 feet in diameter, and range in depth, internally, from 12 to 36 feet. They are built of brick and are steel-encased, and have no supporting members on the inside. The structural steel galleries support the rolling doors that close the tops.

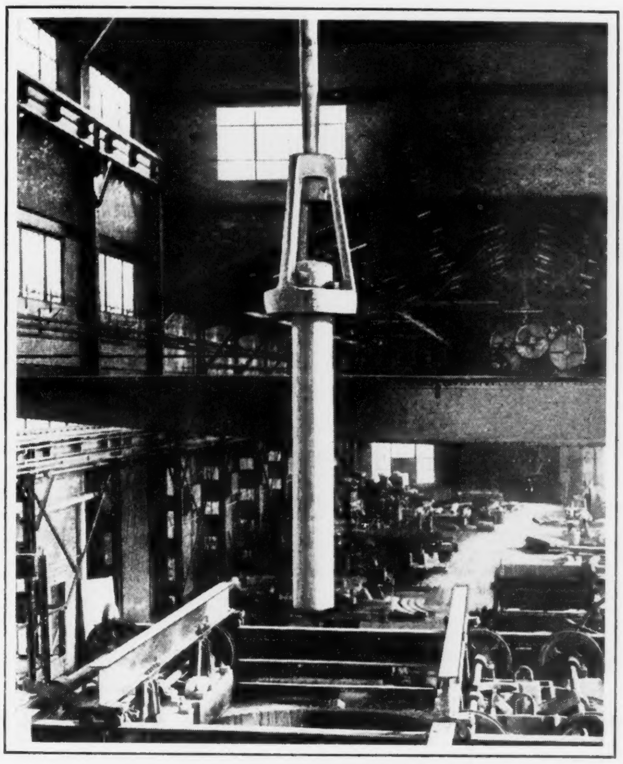


Fig. 2. Lowering a Gun Barrel Casting into the Gas Furnace for Heat-treatment

Manifolds encircle the furnaces from top to bottom, and the gas burners, fired directly into the interior, are supplied from these. They are equipped with inspirators, the gas being supplied under pressure and air being provided in exactly the right ratio for complete combustion, so that the atmosphere within the furnace is free from oxygen, and hence, of reducing characteristics. This keeps the formation of scale at a minimum, and further, with forced circulation of hot gases and perfect combustion, time and labor, as well as fuel costs, are reduced.

After the heat-treatment is completed, the guns are removed to the other end of the building where test bars are cut out, machined, and sent to the laboratories. If found satisfactory, the guns are sent to the machine shop for finishing.

The shell heat-treating room contains a battery of four similar furnaces of about the same diameter, but only 10 feet in depth, also gas-fired through inspirators for perfect combustion and atmosphere control. Armor plate is also hardened and drawn in this section of the plant in a horizontal gas furnace 20 feet long, 10 feet wide, and 8 feet high.

Laboratories Are Engaged in Research and Testing

Physical, chemical, and microscopic laboratories, completely equipped, are maintained, both for research and as a control over the different steps in the manufacture. The melt of steel in the furnace is first tested chemically, and then, after it has been poured into the ingot, it is tested chemically and physically. The forged parts are tested both physically and microscopically. After hardening and drawing, the same tests are again applied.

In the microscopic laboratory, photomicrographs are taken and X-ray examinations are made of castings up to 3 inches in thickness to disclose any physical imperfections, such as blow-holes and sand or slag inclusions.

All steel parts are completely under control, because each melt is numbered and its chemical analysis filed under this number. The physical and chemical test results are then added, so that the entire history of a part, from the laboratory point of view, is always known.

A New Method of Making Guns without Outer Jackets

An entirely new method of gun manufacture, which may well be called revolutionary, has been worked out by the research staff of the Watertown

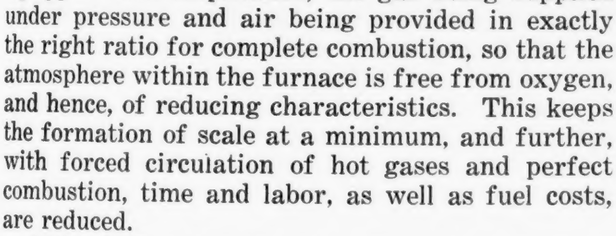


Fig. 3. Looking down into a Gun Barrel Heat-treating Furnace

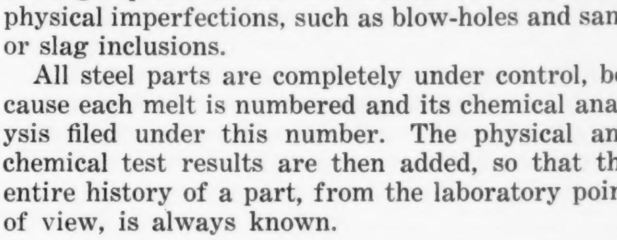


Fig. 4. Boring the Recoil Band of a 16-inch Barbette Gun Carriage

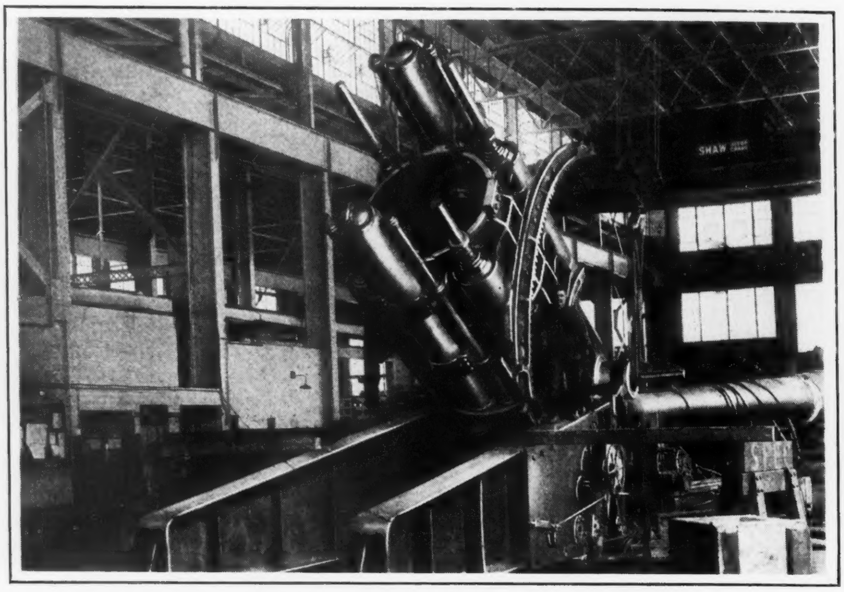


Fig. 5. Mounting the Cradle of a 16-inch Barbette Gun Carriage in the Side Frames

Arsenal. This method eliminates the use of reinforcing outside jackets on guns, and simplifies the heat-treatment. The theory of the use of the shrunk-on reinforcing jacket is that the inside tube

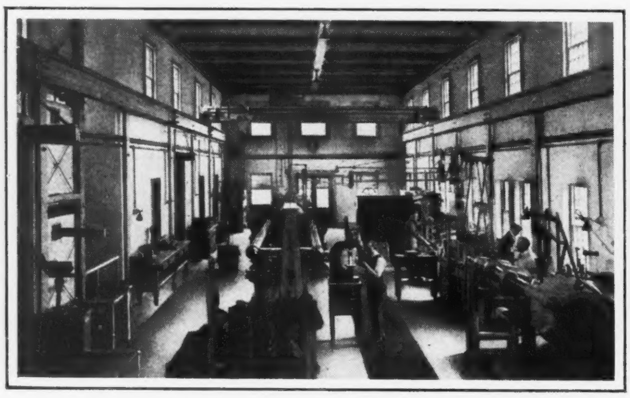


Fig. 6. The Physical Laboratory at the Watertown Arsenal

of the gun must be in a state of compression, while the outside jacket is in a state of tension. While this effect is obtained by shrinking on the outer jacket, a new method has now been developed whereby the same compression and tension in the metal is produced by applying very high hydraulic pressure in the bore of the gun tube, thereby producing compression of the inner strata of the metal and tension in the outer. After heat-treatment, a gun so treated has been found to acquire the same strength as a compound or jacketed gun.

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The Soviet Union purchased in the United States during 1927, through the Amtorg Trading Corporation, 165 Broadway, New York City, equipment and materials valued at over $31,000,000, not including shipments of cotton amounting to $42,000,000.

THE SUPPLEMENTAL BONUS

What has been called the "supplemental bonus" is a device for creating an interest on the part of wage earners in more than mere quantity output. In some instances, the object is to secure greater regularity of attendance. To reduce labor turnover, some firms have made length of service a determining factor in awarding a bonus supplemental to the regular wage, piece-work, or ordinary bonus earnings. Other factors that are considered by some firms in paying such supplemental bonuses are improved quality of the work, prevention of waste, reduction of cost, prevention of accidents, and total shipments during the month.

The supplemental bonus presupposes the payment of a regular wage and salary, and is entirely separate from the ordinary forms of compensation. Nevertheless, it is an earned award and not a gratuitous gift.

The National Industrial Conference Board has prepared a study of the types and scope of supplemental bonus systems in vogue in the United States, together with some opinions concerning

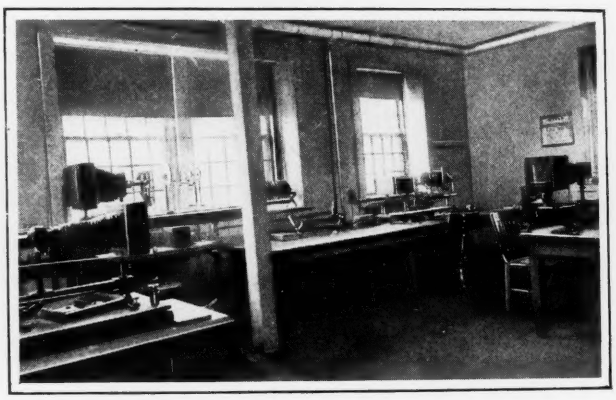

Fig. 7. The Microscopical Laboratory

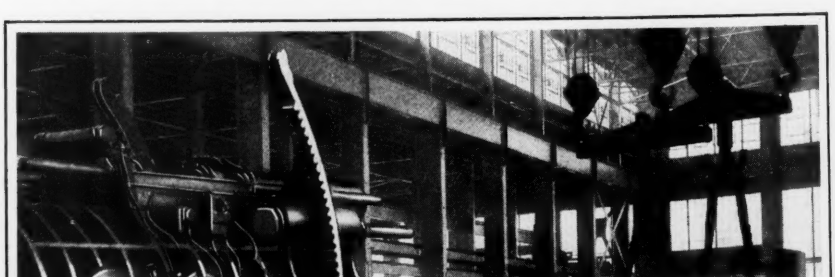

Fig. 8. Mounting a 16-inch Gun in the Cradle of the Carriage

their effectiveness. The study covers the experience of 141 companies employing a total of more than 500,000 workers, of which number about 145,000 were participants in some form of supplemental bonus plans.

The supplemental bonus is being used in numerous instances to obtain maximum cooperation from supervisory forces. In addition to the points on which awards are based for wage earners, salaried supervisors are rated on the following factors: Increased production; maintenance of schedule; suggestions or improvements; arrangement and appearance of department; earnings of department; and departmental record of sales and manufacturing costs compared with investments.

The factors determining the bonus should be those that are definitely connected with the participant's immediate tasks. The plan should be simple and readily within the mental grasp of all who participate in it. The amount of the bonus should be a true reflection of the contribution of the employe receiving it. The plan should not be controlled by the same factors which determine the basic wage, and it should be kept entirely apart from the basic wage.

The plan must be fair and unbiased. It must create a mutual regard between employer and worker. It should offer a sufficient reward to stimulate enthusiasm. If the plan is entirely automatic, there will be little difficulty in allocating the bonus. If it is flexible, allowing for legitimate excuses, a wage earner should be on the committee of awards to assure the workers of a fair consideration of all cases and exceptions.

Fig. 9. A View in the Chemical Laboratory of the Arsenal

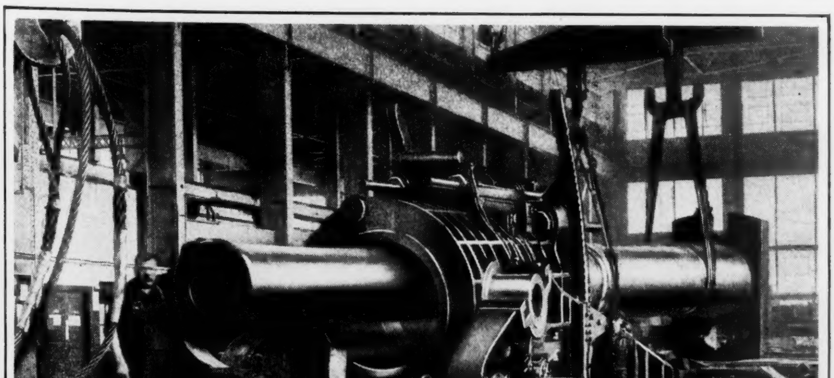

Fig. 10. **Ready for the Final Step in Mounting the Gun in the Cradle**

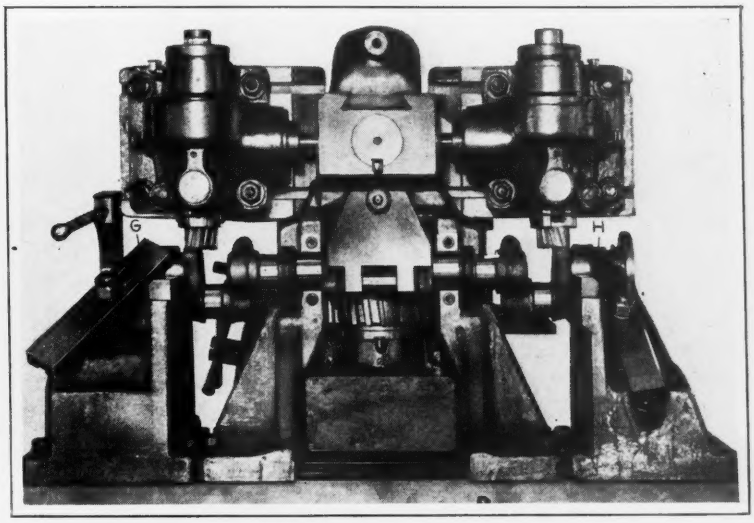

Fig. 1. Milling Counterweight Seats on Crankshaft

MILLING COUNTERWEIGHT SEATS ON CRANKSHAFTS

The high speeds at which automobile engines operate necessitate accurate counterbalancing of the crankshafts. In order to do this efficiently on a quantity production basis, it is necessary that the countershafts and counterweights be accurately machined.

One of the operations in which this object has been satisfactorily attained at the plant of the Atlas Mfg. Co. of Fostoria, Ohio, is the milling of the crankshaft counterweight pads *C*, *D*, *E*, and *F*, Fig. 2, for the Chandler - Cleveland Co. The crankshaft is clamped on a No. 2 plain Cincinnati miller equipped as shown in Fig. 1. Four counterweights are used on this crankshaft. The counterweight surfaces that are in contact with the surfaces milled on the crankshaft are machined at one pass of the work.

The crankshaft is mounted in line with the machine table in a universal fixture, where it is located from the turned main bearings and the crankshaft center throws. Clamps *G* and *H*, Fig. 1, are tightened over the main bearings at the ends of the crankshaft. The throws of the crankshaft are also clamped down. The machining of the pads is accomplished by the use of the auxiliary three-spindle vertical attachment which is mounted on the column and over-arm of the machine. The cutters on the two outer spindles of the attachment pass over the work and mill the end counterweight pads *C* and *F*, Fig. 2, and the centrally located cutter passes under the work and mills the two pads *D* and *E*.

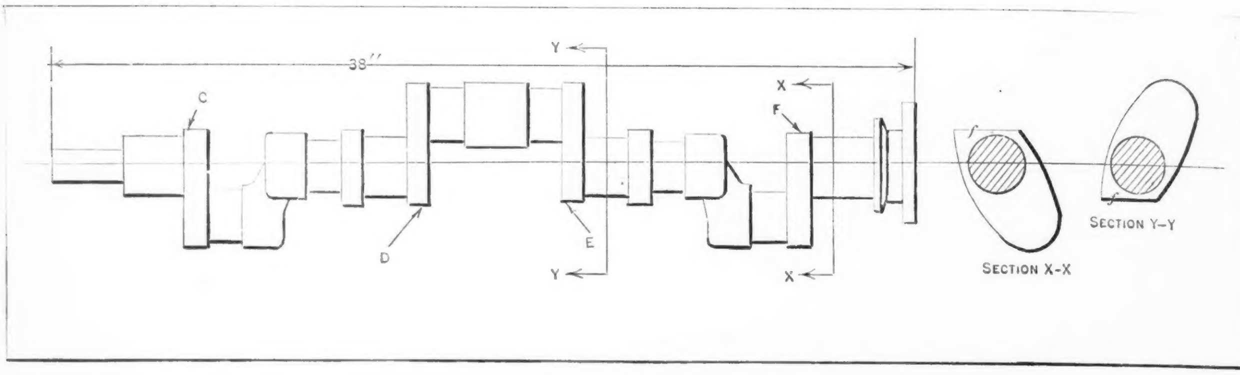

Fig. 2. Type of Crankshaft Milled on Machine Shown in Fig. 1

It will be noted that the outside spindle heads are adjustable to and from the center. This adjustment permits crankshafts of various sizes to be readily handled. The cross-feed of the machine is used in milling the pads. An auxiliary lever arrangement, not shown in the illustration, is employed to bring the work up to the cutters at a rapid speed and return it at the completion of the cutting movement. This saves time in performing the milling operation. The fixture is so arranged that the work can be conveniently loaded at the front of the machine.

From 1/8 to 1/2 inch of stock is removed from the carbon steel crankshaft by the two 4-inch cutters and the 7 1/2-inch cutter. The smaller cutters revolve at a speed of 58 revolutions per minute, and the larger cutter at a speed of 32 revolutions per minute. With a table feed of 2.7 inches per minute, the machining time is 2.3 minutes per piece.

HOWARD ROWLAND

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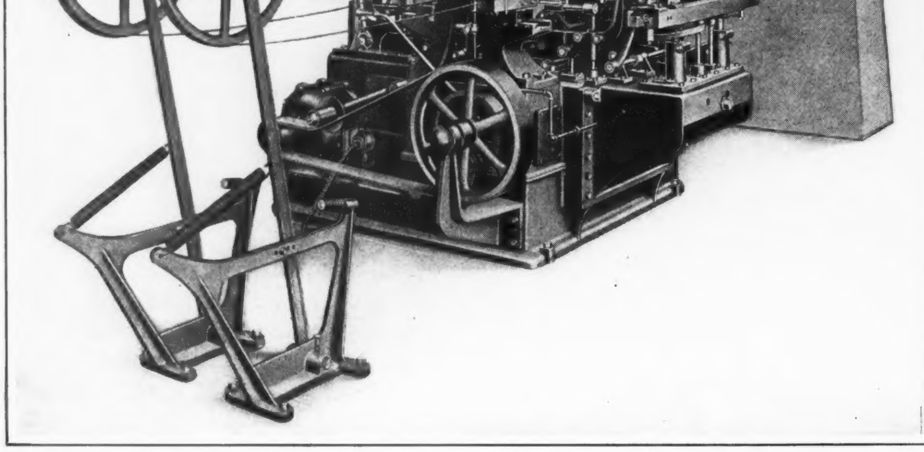
Since 1890, the freight carried by the railroads of the United States has increased fivefold. The average load carried per train has increased from 175 to 770 tons.

PRODUCING THIRTY-FIVE METAL PANS PER MINUTE

Square and rectangular wire-reinforced containers of the type used for tote boxes, bread pans, and for shipping various products are produced at the rate of thirty-five per minute, or 2100 per hour, in a machine recently built by the Roepke Pan Machine Corporation, 161 Ogden St., Newark, N. J. W. J. Roepke, general manager, is the inventor. Pans ranging from 4 by 4 inches to 12 by 12 inches, and 1 1/4 to 4 inches in depth, can be made.

Nine operations are performed automatically by the machine. These consist of feeding the blank, folding the sides and ends, folding the four corners, feeding the wire, straightening the wire, cutting the wire to the proper length, forming the wire at right angles, placing the wire around the pan, rolling the pan rim, and ejecting the finished work. Cams on a shaft located in the base of the machine control its various functions.

Blanks are used as they come from punch presses of the usual type, and are put into a magazine of the machine. They are taken from the magazine by a vacuum arm and placed on a locating mechanism. Next they are fed under the folding mechanism, lengths of reinforcing wire being fed in at the same time. A form then raises the blank against the bottom of the folding mechanism and clamps it there, after which the folding mechanism comes into operation. The finished pan is finally ejected. All mechanisms are accessible for adjustment. A five-horsepower motor drives the machine.



Machine that Automatically Makes Metal Containers at High Rates of Production

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Wire ropes used for carrying ladles with molten metal, or other wire rope that is more or less constantly subjected to a high heat, should be provided with an independent wire rope center of the 7 by 7 construction. The factor of safety of these ropes should be at least 8, and the sheave diameters should be equal to about thirty times the rope diameter.

A New Steel that will Cut Manganese Steel

By A. S. MARTIN, Engineering Department, Firth-Sterling Steel Co., New York

FOR some time, tests have been conducted on the cutting capacity of an entirely new type of high-speed steel, known as "Circle C" steel. This material was developed in an effort to produce a cutting medium that would give greater production than present high-speed steels. During the progress of the experiments, it was soon discovered that the standard test bars were not a sufficiently rigorous test of the remarkable capacity of this steel. It was decided to try the impossible—to machine manganese steel. As is well known in the industry, this metal has successfully withstood the assaults of high-speed steel and challenged the ability of metallurgist and tool steel maker.

While manganese steel has been machined in the past, it has been done at such extremely slow speeds and with such frequent regrinding of tools that it has been considered impracticable for commercial purposes.

The test bars used were rolled manganese steel, 3 inches in diameter with a content of about 12 per cent manganese and 1.20 per cent carbon. The manufacturer of these bars warns the buyer that they "cannot be drilled, milled, planed, or machined with an edged tool, and the only method of finishing is by shearing and grinding."

Tests were Conducted under Ordinary Shop Conditions

The cutting test was unusual. Using a test bar that was supposedly unmachineable, the accustomed "break-down" process was not attempted. Instead, all effort was directed to prevent tool failure. The test had for its object the practical purpose of demonstrating the fact that manganese steel can be machined on a commercial basis; but it seemed reasonable to assume that if a steel has the ability to machine that which is believed unmachineable by ordinary high-speed steels, then it must possess a super-cutting capacity on materials ordinarily machineable. Commercial machining of manganese steel was held to imply that the tool must remove metal at a rate commensurable with the grinding process for at least two hours between grindings of the tool, so that a workman supplied with four such tools could do a day's work with no time lost for regrinding.

Nor were ideal operating conditions sought. The tests were carried on under circumstances that would obtain in almost any ordinary machine shop. The lathe used was a 24-inch back-geared, cone pulley belt-driven, gear-feed machine in fair condition. The lathe tools were forged from 7/8- by 1 1/4-inch "Circle C" steel. In form, these tools were similar to those used on heavy-duty work and in many cutting tests, with a front and side clearance of between 6 and 8 degrees, a top back rake or clearance of 8 degrees, and a top side rake or angle of 14 degrees. The nose had a radius of 7/16 inch (half the width of the tool). The cutting edge was on the center line of the work.

The Cutting Speeds and Feeds that Gave Best Results

During the progress of the tests, cutting speeds ranging from 7 1/2 to 28 feet per minute were tried. It was found that a range of from 7 1/2 to 15 feet per minute gave the best results. When suitable cutting speeds had been established, various depths of cuts and feeds were tried. Within the speed range mentioned, the tools stood up satisfactorily on feeds ranging from 1/60 to 1/50 inch, taking cuts from 1/16 to 5/32 inch deep.

The chip formed was a very tight and compactly curled ribbon—deep dark blue or the brownish gun-metal color peculiar to manganese steel. This chip was "oily-smooth" on the under side, and broke only when it became entangled. Five to ten minutes before the tool was ready to be taken out for regrinding, the chip began to straighten out into a long wavy ribbon which, under an electric light, showed a dull red color for a distance of three or four inches from the cut.

At no time during the test were the tools allowed to fail completely. At the first sign of failure, they were removed and reground. When this stage of failure was reached, the cutting edge was slightly rounded, and at a small spot, concentrated erosion and discoloration were evident. The great pressure against the cutting edge suggested that the work might push the tool away on fine cuts. To determine this point, the tool was set to take a cut 1/64 inch deep which it would hold accurately and without difficulty across the entire length of the test bar, indicating that manganese steel can be machined to close limits.

Heat-treatment Required for New Steel

Considerable attention was given to the heat-treatment of the tools. While the treatment of "Circle C" steel does not differ radically from that of other high-speed steels, it does require a definite increase in the heat used. All the tools tried made better records on the second and third grinds than on the first, from which it was deduced that the high quenching heat required had a tendency to lessen the hardness on the surface of the steel. In general, it was observed that for best results the work must be firmly chucked, the tool well supported, with very little overhang, and the machine rugged. Chattering caused a considerable decrease in the life of the tool. All tests were run dry.

The Results Obtained in the Tests

Summarizing the results, we find that with tools made of steel under test, manganese steel can be commercially machined using cutting speeds of from 7 1/2 to 15 feet per minute, with depths of cuts up to 5/32 inch, and feeds of 1/60 to 1/50

inch. Within the range of combinations of these variables, the time of cut between grindings of the tool runs from one to nine hours.

Similar results have been obtained in machining manganese steel castings, some of which were scrap castings containing sand inclusions and other defects that subjected the cutting tool to an extremely hard test. Further tests now in progress give evidence of equally satisfactory performance on drilling and other machining operations. These cutting tests have progressed to a stage that demonstrates without doubt that a new steel with an unusual cutting capacity has been produced—a steel that marks a definite advance in high-speed steel development. The ability to machine manganese steel alone offers a fertile field for this new cutting medium, but its wider use will undoubtedly be to machine material just on the border line of machineability—just a little outside the safe cutting capacity of ordinary high-speed steels. Such work would include machining billets, car-wheels, heat-treated steels (including alloy automobile steels in the heat-treated forms), phosphor-bronze gears, and other products requiring the tool to cut close to size under severe conditions.

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BIBLIOGRAPHY ON MECHANICAL SPRINGS

A valuable service to the industries has been rendered by the Research Committee on Mechanical Springs appointed by the American Society of Mechanical Engineers. This committee has published a comprehensive bibliography on this subject. All phases of the design, materials, manufacture, specifications, testing, and application of mechanical springs—flat, helical, spiral, conical, etc.—are covered, and a brief abstract given of the sources where information may be obtained. The bibliography is also so cross-indexed as to be of still greater convenience for reference purposes. An introduction giving a resumé of the historical development of mechanical springs is included. Copies of the bibliography may be obtained from the Publication-Sales Department of the American Society of Mechanical Engineers, 29 W. 39th St., New York City, at $1.25 per copy.

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An interesting example of the skill and dexterity that an experienced welder can acquire in handling an oxy-acetylene welding blowpipe is sent us by the Linde Air Products Co., 30 E. 42nd St., New York City. The tremendously hot oxy-acetylene flame is usually employed only for welding fairly large work. Recently, however, an expert welder, using ordinary commercial equipment, repaired a broken link in his watch chain. This delicate job required a steady hand and expert judgment.

Soldering and Brazing

An article on "Soldering and Brazing," which is probably the most comprehensive and complete treatise on this subject that has ever been published in the periodical press, will appear in April MACHINERY. It is based on forty years' experience in joining metals by various soldering and brazing methods. Mr. Eyles, the author, has for the last twenty-four years been foreman of the sheet metal working departments of the London, Midland & Scottish Railway Co., and has recorded, for the benefit of the manufacturing industries generally, many essential facts relating to the soldering art. The article covers the selection of fluxes, and the characteristics of different hard and soft solders, and outlines the methods that must be used and the principles that must be adhered to if strong joints are to be obtained.

ANNUAL MEETING OF THE SCREW MACHINE PRODUCTS ASSOCIATION

At the fifth annual meeting of the Screw Machine Products Association, recently held in Chicago, the following officers were elected to serve for the coming year: President, David Bell of the David Bell Co., Inc., Buffalo, N. Y.; vice-president, Sam G. Eastman, Belvidere Screw & Machine Co., Belvidere, Ill.; treasurer, F. H. Fischer, Fischer Special Mfg. Co., Cincinnati, Ohio; secretary board of directors, John S. Cochran, Mac-It Parts Co., Lancaster, Pa.; field secretary, Malcolm Baird, Central Office, 232 Delaware Ave., Buffalo, N. Y.

After the business meeting, Ernest F. DuBrul, general manager of the National Machine Tool Builders' Association, made an address on the "Dollar Delusion in Depreciation Accounts." The Norton Co.'s film "The Age of Speed" was shown at one of the sessions. It was decided to issue a business barometer each month indicating, on a percentage basis, the relative volume of business secured during the past month and the amount of unfilled orders.

H. B. Lundberg, president of the Michigan Screw Co., who retired as president of the association after several years of service, was given the thanks of the association for his earnest efforts, which have resulted in the present active interest in the association. In addition to the general meetings held twice a year, regular local monthly group meetings will be held in Chicago and Cleveland, and alternately in Dayton and Cincinnati. The eastern division of the association meets at regular intervals in New York City. The annual meeting of this division was also held in February in Brooklyn. George Briggs of the Screw Machine Products Corporation, Providence, R. I., was elected president of the eastern division.

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PRESSED METAL ASSOCIATION

On February 28 a group of stamping manufacturers met at the Cleveland Athletic Club in Cleveland, Ohio, to organize an association of pressed metal manufacturers. This meeting was the result of a preliminary meeting held in Cleveland on January 20 at which W. W. Galbreath, president of the Youngstown Pressed Steel Co., was elected temporary chairman. The purpose of the organization is to consider the problems facing the industry and to endeavor to solve them through cooperative effort and discussion. In view of the large number of stamping manufacturers throughout the country, it was decided to group the different plants so that those having common interests could meet separately at regular intervals where most convenient. The secretary of the organization committee is Malcolm Baird, and the headquarters are at 232 Delaware Ave., Buffalo, N. Y.

CUTTING LARGE SCREWS WITH AN OXY-ACETYLENE BLOWPIPE

An oxy-acetylene blowpipe was recently employed at a large chemical plant for rough-cutting two 6-inch conveyor screws, 30 and 48 inches long, respectively, from solid machine-steel bars. One of the screws rough-cut in this manner is shown in Fig. 1. After prick-punching a single helix of the desired 3-inch pitch the full length of a solid bar, the workmen formed the helical thread groove, as shown in the illustration, by taking successive cuts with the blowpipe at approximately right angles with the axis of the screw. A sheet metal templet cut slightly smaller than the outline of the finished thread groove was used as a guide for the operation.

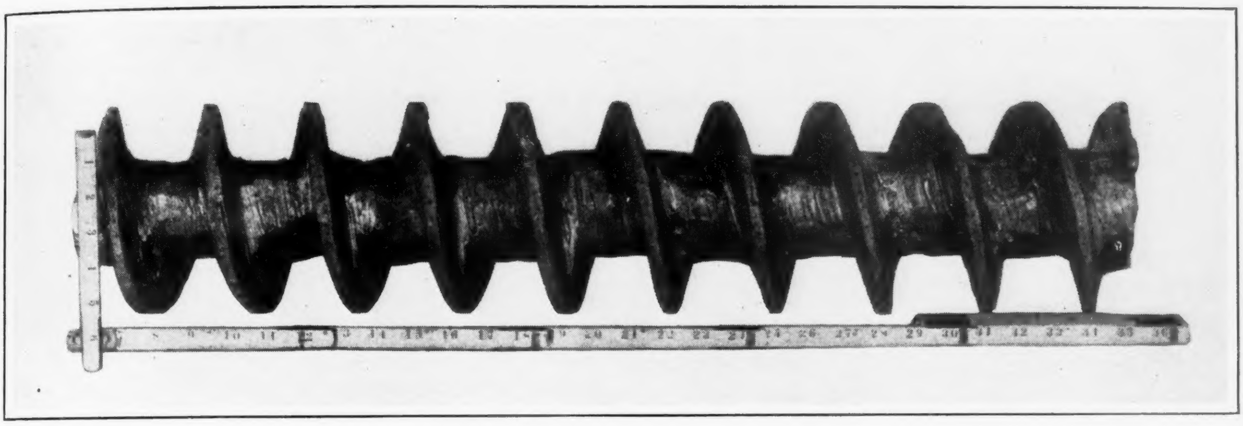

Fig. 1. Screw Cut from Solid Machine-steel Bar by Oxy-Acetylene Torch

As described in *Oxy-Acetylene Tips*, published by the Linde Air Products Co., the procedure was to cut or slice downward along the front side of the thread blade, then across, just outside of the hub circumference, and then upward near the rear face of the adjacent thread. In this manner, a piece of metal approximately equivalent to a quarter section of one turn of the thread groove was removed at each cut. About five hours was required for cutting the 30-inch screw, and eight hours for cutting the 48-inch screw.

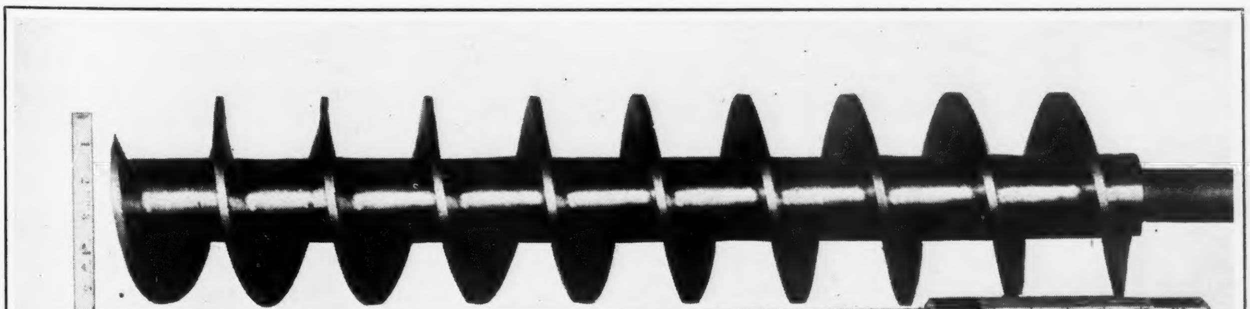

Fig. 2. Screw Shown in Fig. 1 after being Machined on the Lathe

After being roughed out with the blowpipe, the screws were mounted in a lathe for finishing. Side cutting tools having form-ground edges were used to finish the full depth of the thread sides, and a fairly wide-end cutting tool employed to finish the hub. One of the finished threads is shown in Fig. 2. It is interesting to note that, while comparatively little material was removed in finishing, the latter operations consumed much more time than the rough-cutting operations with the blowpipe, although the softness or machining quality of the surface cut with the blowpipe was apparently the same as that of the inner metal.

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COSTLY HAND-TO-MOUTH BUYING

Commenting upon the editorial in December MACHINERY "Costly Hand-to-Mouth Buying," a manufacturer writes that many concerns have come to the point where their buying reminds him of that done by young couples newly married, where strict economy has to be exercised. Retail storekeepers say that it is five cents worth of this and five cents worth of that, even to two potatoes, one for him and one for her.

"Million-dollar corporations," says our correspondent, "are doing precisely the same thing in buying their supplies, and have done so since 1922. I have known of nothing quite so uneconomic as this. Everyone loses, and the astonishing thing about this is that, particularly in the manufacture of small metal-cutting tools, the makers have accepted this kind of buying as inevitable and have not increased prices. On the contrary, in spite of increased costs of everything that enters into the manufacture of these tools, they have forced each other to lower the price.

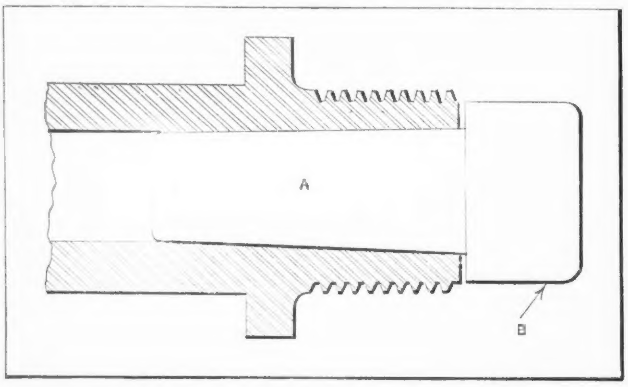
"The article on 'Costly Hand-to-Mouth Buying' is straight to the point. Keep hammering on this condition, and perhaps you may be able to make people change to a sane economic buying policy."

HANDLING HEAVY LATHE CHUCKS

By H. R. HAGEMAN

On page 440 of February, 1927, MACHINERY is described a method of supporting a heavy lathe chuck while placing it on or removing it from the spindle when a crane or hoist is not available. While the method described, which consists of chucking a piece of shafting so that one end slides into the hollow spindle, is convenient in many respects, it has certain disadvantages. In the first place, the heavier chucks are seldom of the universal type, and assuming that we desire to put on an empty chuck with independent jaws, the operation of chucking the shaft with sufficient accuracy to permit screwing the chuck on the spindle consumes too much time.

Again, it is sometimes desirable to clamp a heavy piece of work on a faceplate before placing the faceplate on the lathe spindle. This makes a combination that is difficult to handle even with the assistance of a helper, and the use of the shaft for centering is, of course, out of the question. On some lathes, the threads of the chucks and faceplates are counterbored for nearly an inch to provide a rest and means for centering the attachment to be mounted on the spindle. On lathes thus equipped, the operator can handle quite a heavy chuck or faceplate unaided.



Plug for Centering Chuck on Lathe Spindle

In the accompanying illustration, is shown a method of using a tapered plug *A* to facilitate the mounting of a heavy chuck on the lathe spindle. The end *B* of the tapered plug is turned straight for a distance of about one inch and to a diameter which is an easy sliding fit in the threaded part of the chuck. When the chuck is supported on this projecting end, it can be easily threaded on the spindle. With ordinary care, the threads of the chuck will not be injured by the locating plug, but as a safety measure, the plug could be turned down to permit pressing on a heavy copper ferrule.

* * *

One of the most significant facts of today is the improved economic position of the American wage earner. This is due not alone to higher wages, better working conditions, and greater opportunities to share in the management and profits of business; it is due also to a wholesome desire on the part of industry itself to promote that increasingly large part of the purchasing power of the public which is represented by the wages of industrial workers.—*Charles M. Schwab*

STANDARDIZATION OF TAPS

The tap and die manufacturers, in common with other American industries, have united to standardize their product for the general benefit of the users. In cooperation with the National Screw Thread Commission, the automotive industries, and leading manufacturers of electrical and mechanical products, standard dimensions and tolerances for different classes of taps have been adopted. These standards are now published in convenient pamphlet form and are obtainable from any one of the leading manufacturers of taps and dies.

A similar pamphlet was published in May, 1924, but since that time much additional work has been done, and the principal additional features covered by the new publication are: (1) Adoption of larger major diameters to allow for greater wear; (2) increase in minimum pitch diameters on taps over 3/4 inch, to compensate for lead errors; (3) adoption of a comprehensive standard for ground-thread taps; (4) a large number of new tables on standardization of elements not previously covered.

The tolerances for taps shown in the publication issued by the tap and die manufacturers correspond to the recommendations of the National Screw Thread Commission. Except in a few instances, where noted, cut-thread taps when used under normal conditions should, in the majority of cases, produce holes within the National Screw Thread Commission's Class 2 tolerances; while ground-thread taps used under normal conditions should, in the majority of cases, produce holes within the National Screw Thread Commission's Class 3 tolerances. It is emphasized, however, that owing to the wide variation in manufacturing methods and shop conditions, the size of the tapped hole cannot be guaranteed, a fact well known to all experienced users of taps.

The tap manufacturers further emphasize the fact that as these changes are most far reaching, and therefore affect a very large percentage of the taps in stock throughout the country, it is not possible to make the new standards effective at once; but it is hoped that tap users will cooperate in the gradual establishment of the new standards by accepting taps made to the old standards until such time as the new product will be generally available.

The pamphlet contains forty-one different tables covering every important type of tap and containing numerous tables relating to tolerances. It is a publication that should be in the hands of every tap user, as it is a complete handbook on tap dimensions, tap tolerances, and tap drill sizes.

* * *

The use of ice for road-building is somewhat of a novelty, but according to the *Compressed Air Magazine*, it has been tried with success in Russia in logging operations. Recently 350,000 cubic feet of wood were transported during the three-month winter period over an ice-topped road about 2 miles long. Because of the reduced friction, as compared with haulage over snow, the horses used for hauling the lumber were able to pull several times the usual load.

New Machinery and Tools

The Complete Monthly Record of New Metal-working Machinery

MOLINE HYDRAULIC-FEED CYLINDER BORERS

The line of multiple-spindle cylinder boring machines built by the Moline Tool Co., Moline, Ill., has recently been redesigned with a view to adapting the machines to the most advanced methods of production. Two of the improved machines, Nos. 13 and 10-D, are shown in Figs. 1 and 2, respectively. Both have a hydraulic feed, using Oilgear equipment, and both have guides of a new type.

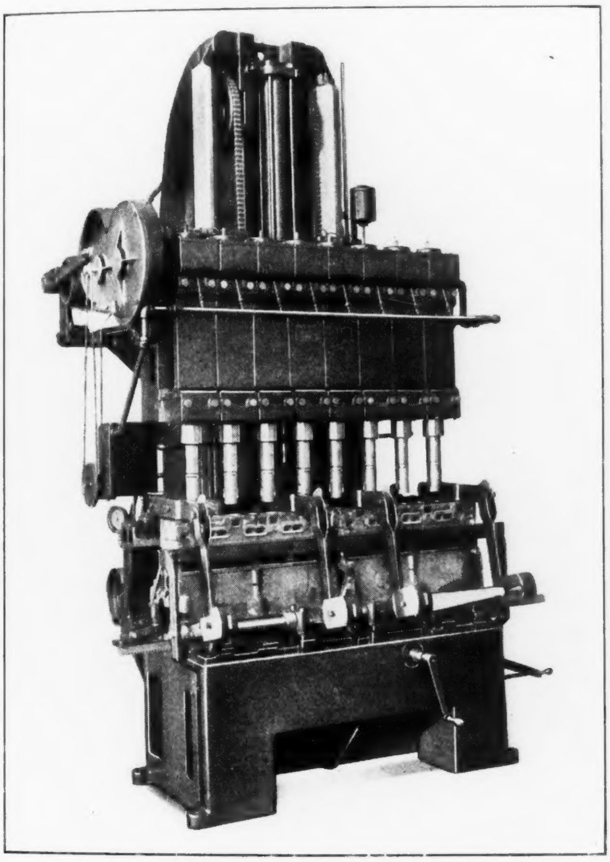


Fig. 1. Moline Hydraulic-feed Cylinder Borer of Improved Construction

From the cross-sectional view of the slide and column, which is shown in Fig. 3, it will be seen that the double V-guides so commonly used on other types of machine tools are now employed on Moline cylinder boring machines. The hydraulic-feed cylinder is mounted centrally between the two guides. Advantages of this construction include the elimination of any tendency of the slide to "weave" during a heavy cut. The slide is held securely against the V-guides in a new manner by means of four tapered gibs, as shown in Figs. 3 and 5. This feature is believed to be entirely new in machine tool construction, and facilitates accurate adjustments. Anti-friction bearings are used on all drive shafts, including the main spiral shafts.

The No. 13 machine (Fig. 1) is particularly recommended by the manufacturer for heavy boring operations, the machine being so rigidly constructed that piloting of the boring-bars at either the top or bottom is not necessary, although this can be provided for if desired. The column or housing is of box section and extends to the floor, the base being bolted to the column face. The machine is counterbalanced by weights within the column.

The main drive is either direct from a motor or from a countershaft. A belt tightener is furnished.

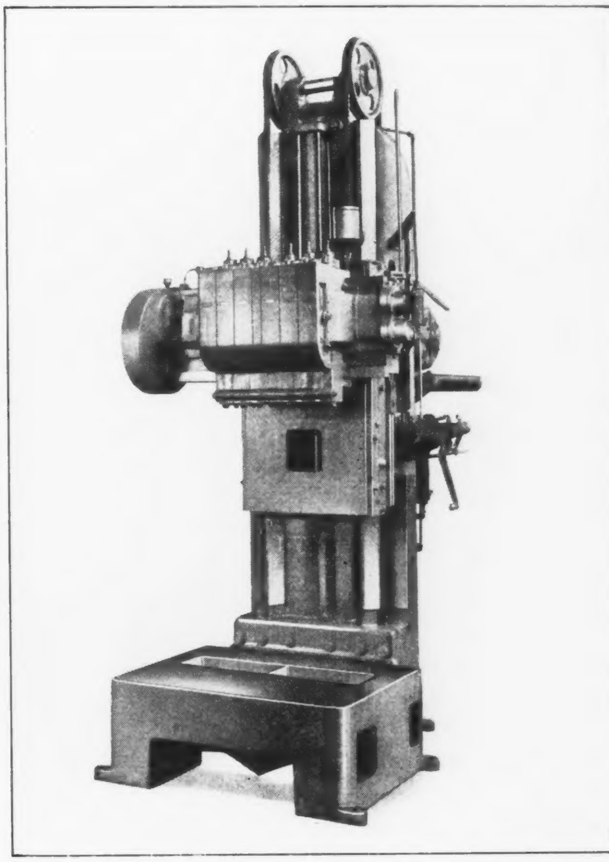


Fig. 2. Another Moline Cylinder Borer with New V-guides

From the main drive shaft power is transmitted to the hardened spiral drive shaft through spur gears which are also hardened.

The sides of the spindle housings or heads are scraped and furnished with spacers, so that all heads can be conveniently bolted together to the desired spacing. This gives the effect of a solid-group spindle head, and yet has the advantage of enabling spacings to be quickly changed. Fig. 4 shows the cross-section of a head unit, from which it will be seen that each spindle is mounted in Timken tapered roller bearings. These bearings can be adjusted for the slightest amount of wear by simply turning the nut on the top end of the spindle. Bronze spiral gears mounted on the spindles mesh with the main driving spiral. The entire assembly is flooded with oil through a force-feed

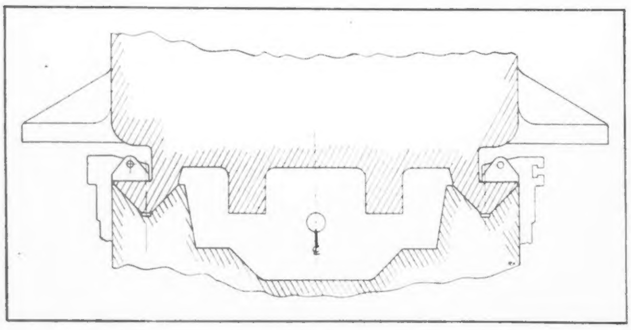


Fig. 3. Cross-sectional View of V-guide Construction

circulating system, the oil being drained at both the top and bottom spindle bearings to insure against oil leakage around the spindles.

The motor used for driving the spindles is also employed to drive the Oilgear pump. The cylinder is 3 7/8 inches in diameter, and gives a 36-inch stroke. The entire control of the feed cycle is automatic, the operator only having to shift a starting lever. This causes the rail on which the spindles are mounted to be brought down rapidly to the cutting position, whereupon the lever shifts to the slow feed. Upon the completion of the boring operation, the lever again shifts automatically to the reverse position, and gives a rapid return of the rail unit. When the cycle has been completed, the feed is thrown out until it is again engaged by the operator. Feed rates can be changed by simply adjusting a conveniently located valve on the Oilgear pump. The oil circuit can be arranged to give two slow feeds forward, where this is desired.

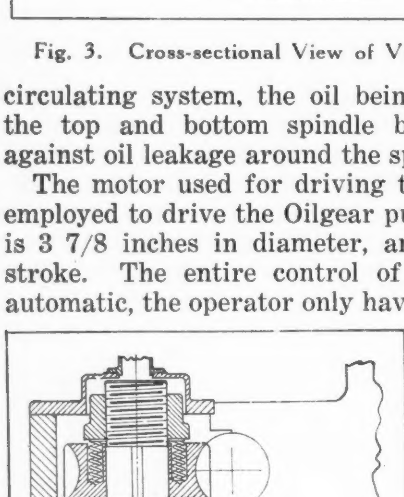


Fig. 4. Cross-section through Roller-bearing Spindle Head

Fig. 1 shows the machine completely tooled for an eight-cylinder engine. The work fixture clears the face of the column, and is bolted to wings on the sides of the column, the construction permitting the use of a long slide. Adjacent spindles bore alternate holes in the block, this arrangement being necessary because the spacing of the cylinder bores is too close to permit machining adjacent bores with roller-bearing equipped spindles. One cylinder is completed at each cycle of the machine.

The castings are brought to the machine on a conveyor located approximately at the same height as the jig, and are pulled into the jig by means of a latch mounted on a rack which is operated through the crank at the front of the machine. Each time a new block is pulled into the fixture, the one just completed is forced out at the right-hand side of the machine. After the blocks are in place, the lever at the right-hand side of the base is depressed, thus raising locating pins into holes in the pan rail to locate the blocks for the operation. Then, by the movement of another lever, weights are dropped to clamp the two castings securely. Adjustment of the clamping levers is accomplished through eccentric plates at the top of the clamps.

The No. 10-D machine (Fig. 2) is similar to the No. 13, with the exception that it is smaller and that the spindle units have tapered bronze bearings instead of roller bearings. This construction permits closer center distances of the spindle heads. The machine is recommended by the manufacturer for use when the boring-bars are piloted at the top and bottom of the work fixture. The feed control and all Oilgear equipment is identical to that used on the No. 13 machine.

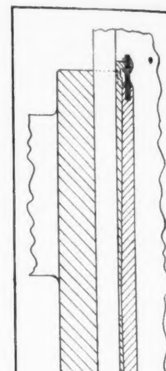
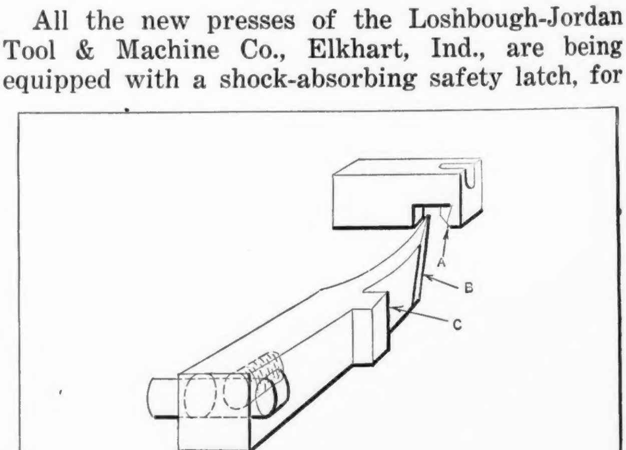


Fig. 5. Taper Gibs for Slide

On the No. 13 cylinder borer, the center distance between the two V-guides is 27 1/2 inches; the floor space required is 7 feet 8 inches by 6 feet 4 inches; and the approximate shipping weight is 22,900 pounds. On the No. 10-D cylinder borer, the center distance between V-guides is 21 1/2 inches; floor space, 7 feet 2 inches by 5 feet 4 inches; and shipping weight, 16,500 pounds.

LOSHBOUGH-JORDAN SHOCK-ABSORBING LATCH

All the new presses of the Loshbough-Jordan Tool & Machine Co., Elkhart, Ind., are being equipped with a shock-absorbing safety latch, for



Shock-absorbing Latch for Punch Presses

which patents have been applied. The purpose is to stop the momentum of the shaft with the latch instead of with the brake. With this latch it is possible to operate presses at from 25 to 50 per cent higher speeds than is usually recommended, without sacrificing the safety of the press or operator. The latch practically eliminates the brake.

In addition to increased speeds, a saving of power is claimed, inasmuch as 10 per cent of the power formerly required to operate a press was consumed by the brake, and with the brake eliminated, there is a distinct saving in power. The new latch may also be installed on any L-J press now in use.

The accompanying diagram shows the operation of the latch. The beveled slot *A* in the clutch pin engages the wedge surface *B* of the latch when the clutch pin is extracted from the flywheel, and the shoulder *C* receives the impact of the clutch pin. The shock is absorbed by spring *D*.

CINCINNATI-ACME TURRET LATHE FOR BOTTLE MOLDS

Blanks and molds used in bottle-making machinery can be machined on a production basis in a turret lathe developed by the Acme Machine Tool Co., Cincinnati, Ohio. This machine is designed for blanks and molds having one, two, three, or four cavities. The blanks and molds are close-grained iron castings made in halves, which are hinged together for use, as shown at the front of the machine in Fig. 1. The cavities are chilled, and they must be machined to within plus or minus 0.001 inch of the specified center-to-center distance.

Prior to the turret lathe operations, the adjoining surfaces of the halves are ground, and the two halves can thus be fastened firmly together for the various turning and boring cuts performed in this machine. For the first turret lathe operation, the work is mounted in the faceplate fixture, which can best be seen in Fig. 2, this fixture being of such a design that it can be positioned to bring the center of the work or the center of either cavity in alignment with the center line of the machine. The fixture is first positioned to bring the center line of the blank or mold central with the spindle, after which the outside diameter is turned to size, and various surfaces on the extending end of the casting are faced. The flange is also back-faced. These cuts are taken with tools on the side carriage.

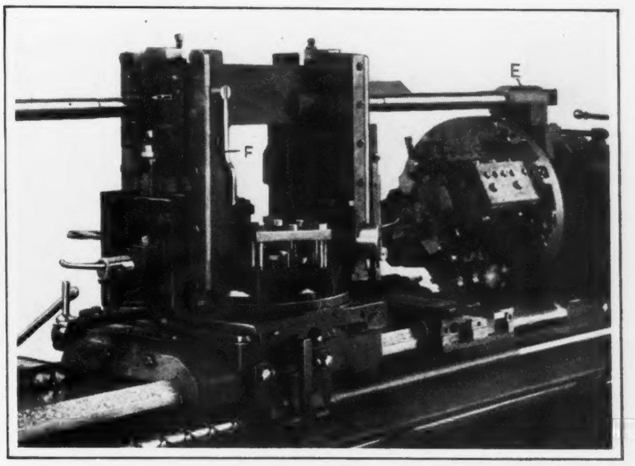


Fig. 2. Close-up View of the First-operation Indexing Fixture and the Tooling

With a two-cavity blank or mold, such as illustrated, the next step in the operation is to index the fixture sidewise sufficiently to bring the center of one cavity into alignment with the center of the machine. Then rough and finish profile-boring cuts are taken on the cavity for approximately one-half its length, the tools being guided by an overhead attachment during these operations. A counterboring cut is also taken in the forward end of the cavity. These cuts are all made by tools held on the flat turret. When they have been completed, the faceplate fixture is again indexed sidewise to bring the second cavity into line with the center of the machine, after which the cuts taken on the first cavity are repeated on the second. Each time the fixture is shifted sidewise on the faceplate, weights, such as are seen behind the faceplate at *A*, Fig. 1, are adjusted to counterbalance the set-up of the fixture and the work.

The profile cuts are taken with tools mounted on auxiliary slides of vertical slides *B* and *C*. A micrometer screw and graduated dial permit accurate settings of the auxiliary slides on the vertical slides. The tools and slides are automatically moved up and down to suit the profile of the cavities. This is accomplished by a guide fastened to each of the slides, which passes along cam *D*. The cam is attached to a bar which is hinged on a support fastened to the headstock. The hinged arrangement provides for easily swinging the cam away from the turret when it is not in use, in order to give ready access to the fixture.

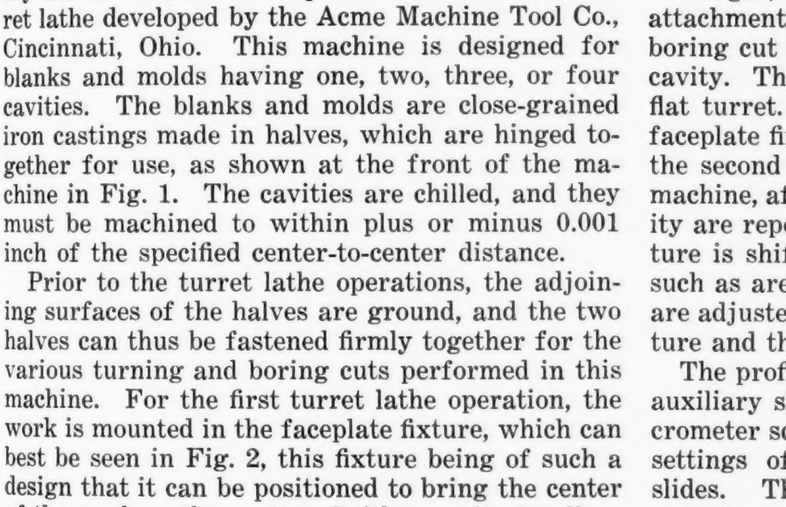


Fig. 1. Cincinnati-Acme Turret Lathe Arranged for Machining Bottle Blanks and Molds on a Quantity Production Basis

During each profile-boring cut, the turret is steadied and accurately guided by a pilot, which enters bearing *E*, Fig. 2. When the finish profile-boring cuts are ended, the operator raises lever *F*, Fig. 2, which is furnished for each vertical tool-slide. This actuates a mechanism that relieves the tool from the work as it is withdrawn, and prevents scoring.

When the first end of a lot of parts has been finished, the fixture is removed from the faceplate and another substituted for holding the work with the opposite end forward. The cuts on this end vary somewhat with the job. On the mold illustrated in Fig. 1, the cut consists of facing

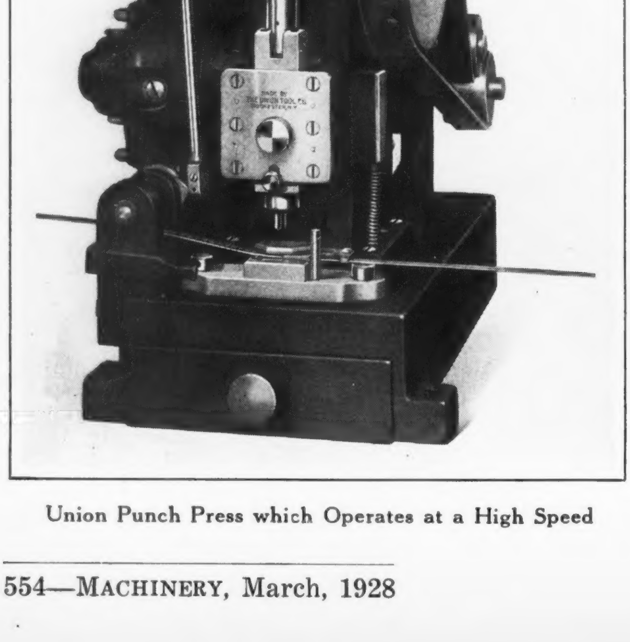
a narrow rim and counterboring to a large diameter while the work is held central with the center line of the machine. Then, after shifting the fixture sidewise to bring one of the cavities in line with the center of the machine, profile-boring cuts are taken on the front half of the cavity and a back facing cut is taken on the cavity shoulder. These cuts are then repeated on the second cavity. Cam *D* is also used in this operation.

Interchangeable fixtures or chucks of various designs can be provided for use on this machine, and the tooling can also be varied to meet individual jobs. The machine itself is the Cincinnati-Acme standard No. 3 universal flat turret lathe.

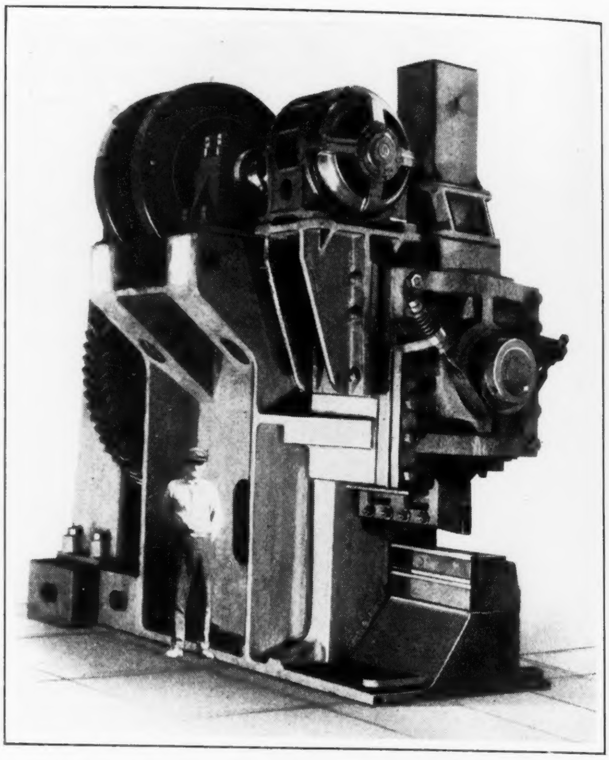
UNION HIGH-SPEED BENCH PUNCH PRESS

A bench punch press which operates at high speed has been developed by the Union Tool Co., 299 Norton St., Rochester, N. Y. It is stated that this machine can produce 20,000 blanks per hour. Another feature is that the machine employs dies of inexpensive design. The press can be driven by connecting it to any light socket for furnishing current to the 1/3-horsepower motor with which it is equipped. The machine has a safety clutch and also a positive knock-out arrangement in the slide. There is a drawer in the base which is partitioned to separate slugs from blanks. The roller feed has an adjustment of from 1/16 to 3/4 inch. A Veeder counter is provided.

Metal 1/64 inch thick can be punched to a diameter of 1 1/2 inches, and metal 3 3/32 inches thick, to a diameter of 3/8 inch. Other important specifications are as follows: Width of opening in back of press, 1 1/2 inches; stroke of slide, 3/4 inch; adjustment of slide, 1 1/8 inches; dimensions of base, 8 inches wide by 18 inches long; over-all height of machine, 18 inches; and net weight, 160 pounds.



Union Punch Press which Operates at a High Speed



Mackintosh-Hemphill Improved Open-throat Shear

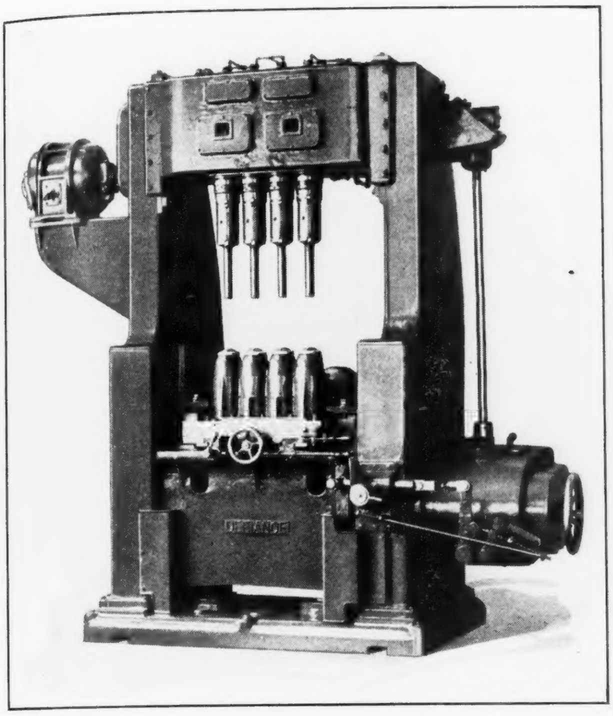
MACKINTOSH-HEMPHILL OPEN-THROAT SHEAR

An improved type of open-throat shear capable of cutting cold alloy steel up to 4 1/2 inches square or 5 inches round was recently built by the Mackintosh - Hemphill Co., Pittsburg, Pa. This shear weighs about 225,000 pounds and has a knife pressure of 1,400,000 pounds. Its total height is about 16 feet, and the weight of the shear frame alone is over 40 tons. The stroke is 6 1/2 inches long, and about fifteen cuts can be made per minute. A 12 horsepower motor located on top of the frame drives the shear.

The motor pinion shaft is provided with two 63-inch flywheels which are spaced symmetrically on the shaft to equalize the load on the shaft bearings. All gears, including the master gear and pinion, have cut herringbone teeth. The flywheels, as w as all gears, are enclosed by oil-tight covers.

The eccentric shaft is provided with a square end on which a loose clutch slides. This shaft is supported by two bearings on the shear frame and by an outboard bearing at the clutch end and another in the faceplate. The eccentric is equipped with a solid bronze slide which is mounted on the top ram. Bronze liners are also supplied between the ram and the shear frame, while the front side of the ram is equipped with an adjustable wedge for taking up wear in the ram. An air-operated jaw clutch is mounted on top of the frame.

The top knife block is balanced by a double spring, which is easily accessible for adjustment or replacement. To insure that the top knife block will stop in the upper position, there is a band brake at one end of the eccentric shaft. This brake automatically comes into action as the ram reaches the top of its stroke, and is released when the material is being cut. Provision has been made for supplying ample lubrication to all moving parts of the machine.



Defiance Four-spindle Cylinder Boring Machine

DEFIANCE CYLINDER BORING MACHINE

A special extra heavy No. 8 four-spindle fixed-center cylinder boring machine, designed for rough-boring, semi-finishing, or reaming tractor cylinders having any number of bores, or automobile cylinders cast en bloc or singly, has recently been placed on the market by the Defiance Machine Works, Defiance, Ohio. The machine gives a production of from fifteen to twenty-five blocks per hour.

The construction of the machine throughout is extra heavy and rigid, the purpose being to eliminate all chatter of the cutters and thus enable smooth, clean holes to be bored or reamed. The feed mechanism is of unit construction and easily accessible. It is tightly enclosed and is designed to retain sufficient oil to effect splash lubrication. End thrusts on all feed shafts are taken by S K F ball bearings. Feed changes can be made by simply removing a gear-case cover and changing two gears.

A hand adjustment is provided for the table feed, but when the machine is in operation, the table automatically feeds the work to the boring tools, and when the cut is completed, the table is automatically reversed and returned at a fast rate of travel to the loading position. Here the table stops until the feed is engaged again for boring the next cylinder. By means of double clutches in the feed-box, the machine can be set to feed, disengage, travel rapidly upward, feed again, disengage, and return.

The drive to the spindles can be transmitted by belt from a three-step cone pulley or from a motor connected direct to the drive shaft by means of a flexible coupling. Each spindle is large in diameter and is supported by three bronze bearings. The nose bearing is of conical shape, and has a convenient adjustment for taking up wear. Each spindle floats between two sets of S K F ball bearings which receive all end thrust. Momentum of the spindles can be instantly arrested after the power is shut off by means of a friction brake positioned close to the operator. The boring tools are fitted to the spindles by a taper shank, and each tool is securely held in place by a long bolt which extends through the spindle from the top. The arrangement eliminates any chance of the tool being extracted from the spindle during the return feed.

The auxiliary sliding table is mounted on heavy slides, and is operated in and out with a screw driven by a separate motor at the back of the machine. This motor functions through a right- and left-hand slip friction clutch. A lever for controlling the clutch is located at the front of the machine, convenient for the operator. When the sliding table is at the front, it is possible to load the cylinder blocks over the fixture. The latter contains revolving bushings which the pilot bars enter before cutting takes place.

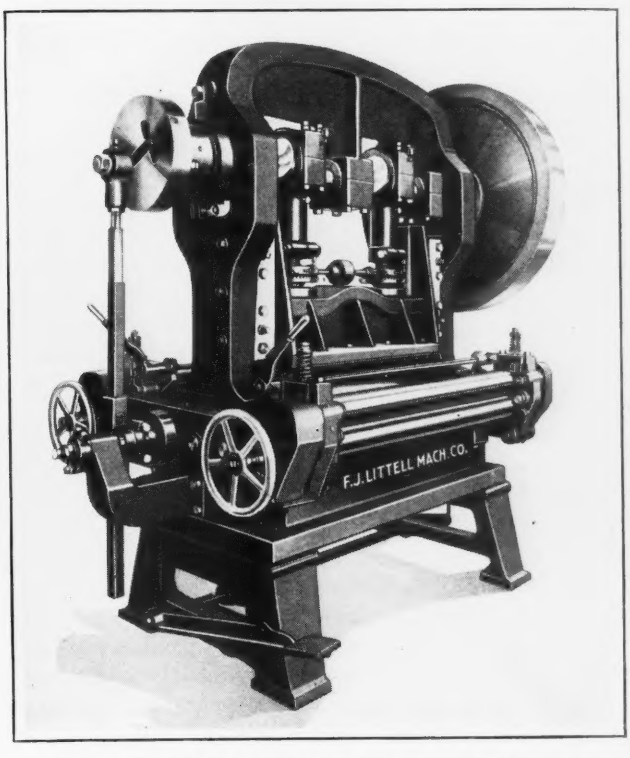
Jack screws raise and lower the table. Each screw is actuated by worm-gearing and a bronze nut. Each jack is a unit in itself, and the moving parts are packed in grease. There is a simple adjustment for advancing or retarding the screws independently in order to maintain table alignment, and all thrusts are taken by S K F ball bearings.

From 15 to 25 horsepower is required to drive the machine. The floor space occupied is 11 feet by 6 feet 10 inches. The net weight of the machine is approximately 21,330 pounds.

LITTELL ROLL FEED FOR PUNCH PRESS

A punch press feed recently developed by the F. J. Littell Machine Co., 4125-4127 Ravenswood Ave., Chicago, Ill., is shown on a machine in the accompanying illustration. This feed is designed for use on a double-crank press, and has a blanking capacity of over 1,000,000 pieces per day.

The feed is of the double rack and pinion type. Any material up to 1 inch in thickness, including



Littell No. 14 Double Rack and Pinion Roll Feed on Double Crank Press

rubber, can be fed. In one test, thirty-seven rubber pieces were blanked out per stroke, with the press operating at a speed of 80 revolutions per minute. A handwheel which does not revolve when the feed is in operation can be used to feed the stock forward. The feed is also provided with a hand-lifter as well as an automatic lifter.

LANDIS HYDRAULIC VALVE FACE GRINDER

The semi-automatic hydraulic valve face grinder here illustrated, which has recently been brought out by the Landis Tool Co., Waynesboro, Pa., is primarily a high-production machine for grinding similar parts in large quantities. It is only necessary to change the work-holding fixture when changing from one size or type of valve to another. Such units as the bed, base, rear drive, oil-pump, and water service are the same as used on the Landis 6-inch plain hydraulic machine, but the work carriage, work-head, and cross-slide have been especially designed for valve grinding operations.

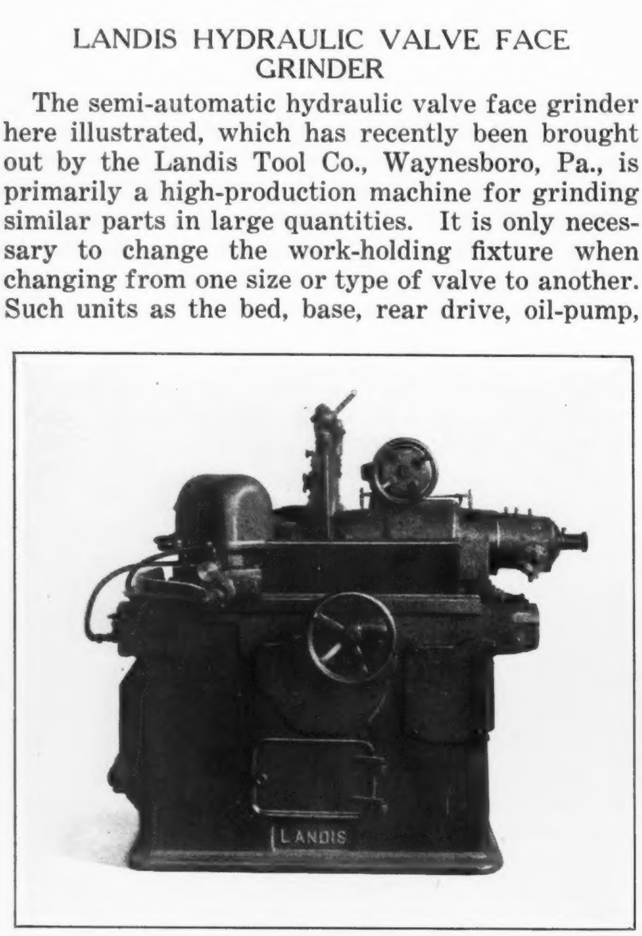


Fig. 1. Landis Semi-automatic Hydraulic Valve Face Grinder

The live-spindle work-head is mounted at an angle of 45 degrees on a cross-slide which moves at right angles to the axis of the grinding wheel spindle. A hydraulically operated piston at the rear of the head moves the cross-slide toward or away from the wheel. A 1/2-horsepower constant-speed motor, mounted on the head itself, drives the work-spindle through a silent chain and sprockets. The movement of the head automatically controls the rotation of the spindle by means of an electrical limit switch on the under side of the slide. A single lever at the front of the slide, which is connected with a reversing valve, controls the movement of the slide.

The work-holding fixture is operated by an air cylinder at the rear of the work-spindle, and consists of a clamping block on which the valve stem is placed, a clamping arm which carries the clamping shoe and a locator which positions the valve properly for grinding. As in the case of the work-spindle rotation, movement of the work-head automatically regulates the clamping and releasing movements of the clamping shoes.

When the work-head is in the rear position, the work clamping shoe is released and rotation stopped, so that a valve can be placed in the work-holder. When the control valve is pushed away from the operator, the work-head moves toward the grinding wheel, the work is clamped, electrical contact is made, and the work starts to rotate. The work-head continues to move rapidly toward the grinding wheel until contact is made between the wheel and the work, when the movement automatically slows down to the predetermined grinding feed, and continues to move in until it reaches a positive sizing stop. After the work has made several revolutions in order to allow the wheel to cut to size, the control lever is reversed, causing the work-head to move back rapidly. As the head approaches the extreme rear position, the electrical connection is broken, the work stops rotating, and at the same time is automatically released.

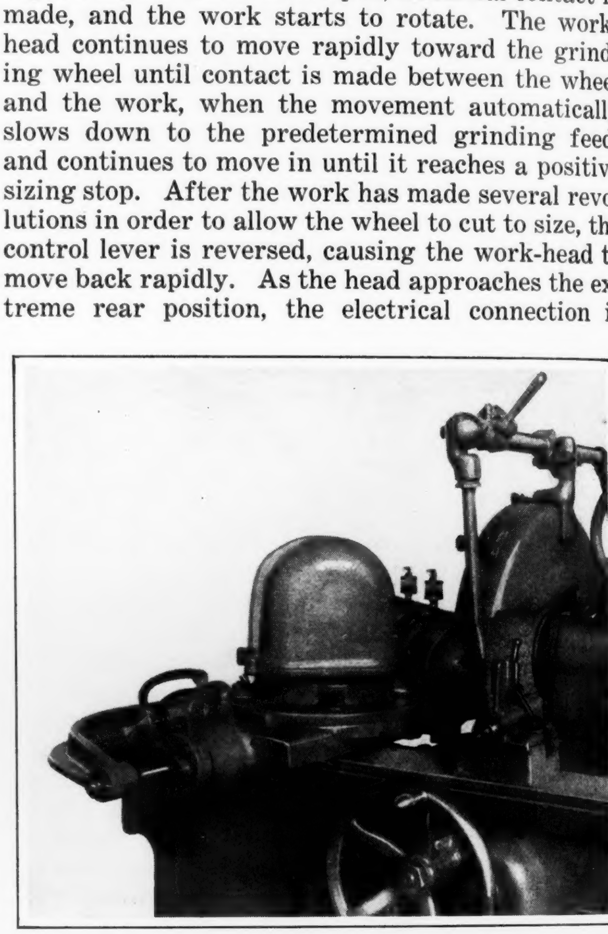


Fig. 2. Work-head, Wheel-head and Truing Device of Landis Valve Grinder

The reciprocating spindle of the grinding wheel head runs in pressure-lubricated bearings. A reciprocating wheel-spindle is used to eliminate wheel marks on the work and cause even wear of the wheel face. On this particular machine, the lateral movement is 1/2 inch. There is a standard wheel truing fixture.

Power for the work-head feed is furnished by a geared oil-pump driven from the rear drive shaft. A portion of the machine base is utilized as a container for the oil. The work carriage is traversed by hand, a back-gear arrangement giving a slow speed for truing the grinding wheel. The machine may be arranged for either a lineshaft or a direct motor drive, although in either case an electrical work-driving motor is required. A main drive motor of five horsepower capacity, running at 1150 R.P.M. will meet the power requirements.

MILD STEEL WELDING ELECTRODES

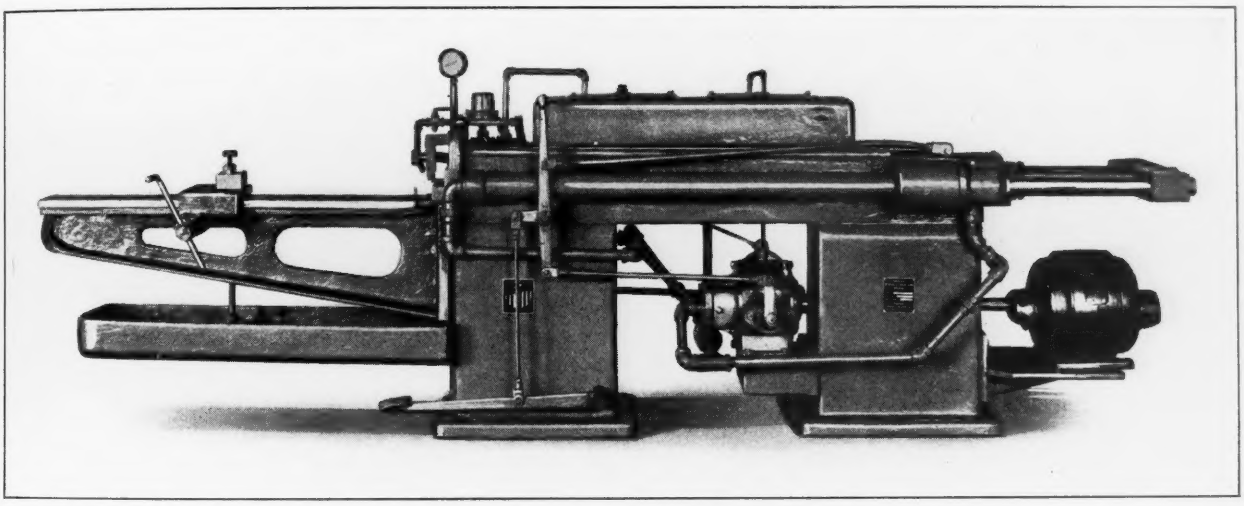
Two mild steel welding electrodes have recently been developed by the Fusion Welding Corporation,

103rd St. and Torrence Ave., Chicago, Ill. On account of their color, these electrodes are known as "Blue Streak" and "Yellow Jacket," respectively. The "Blue Streak" electrode is unusually fast flowing, melting very rapidly. At the same time, it has unusual arc stability. It is especially suited to the welding of medium and light gage plates and sheets. It is a full flux coated electrode.

The "Yellow Jacket" is a surfaced electrode which gives extreme penetration when used with high current on heavy material. With this electrode, 1/2-inch steel plates have been successfully welded without beveling the edges, at a rate of over 20 feet per hour.

AMERICAN HYDRAULIC BROACHING MACHINE

A No. 2 hydraulic broaching machine which incorporates the features of variable-speed cutting and return strokes has been recently brought out by the American Broach & Machine Co., Ann Arbor, Mich. In the illustration, the machine is shown equipped with a support table, carriage, and oil-pan. The finished face at the front of the machine, for attaching the support table and fixtures, extends to within a few inches of the floor.



American Hydraulic Broaching Machine with Variable Feed Control

The twin cylinder construction used on other horizontal hydraulic broaching machines built by the concern is employed. With this construction, pressure is applied to the full area of the piston, thus avoiding a high pressure on the packing glands. The cylinder bores are 2 1/4 inches in diameter. There are three rams, one for each cylinder and one for operating the sliding head. All three rams are connected by means of a cross-head and operate simultaneously. The cutting speed ranges from 0 to 28 feet per minute, and the return speed, up to 60 feet per minute.

The cylinders are made of steel and their bores are machined and honed. The pistons have two conventional-type piston-rings and leather cups. The machine is equipped with hand- and foot-lever controls, and a direct-reading gage indicates the amount of pressure applied. The operating pressure of the hydraulic pump is 1000 pounds per square inch, and the capacity of the oil tank is approximately 15 gallons.

The bore in the face of the machine on which the work is mounted is 5 inches in diameter, and the broach pulling head has a 2-inch tapped hole with eight threads per inch. The stroke is sufficient for operating broaches up to 50 inches in length. A vertical adjustment of 1 1/2 inches above center and 1 inch below is provided. A five-horsepower constant-speed motor, running at 900 revolutions per minute, is required to drive the pump. The machine weighs 4000 pounds.

GENERAL ELECTRIC DRUM SWITCHES

Three drum switches intended for use with squirrel-cage and slip-ring motors, have been placed on the market by the General Electric Co., Schenectady, N. Y. These switches are designed especially for the control of small cranes, hoists and machine tools, but can also be applied on other equipment.

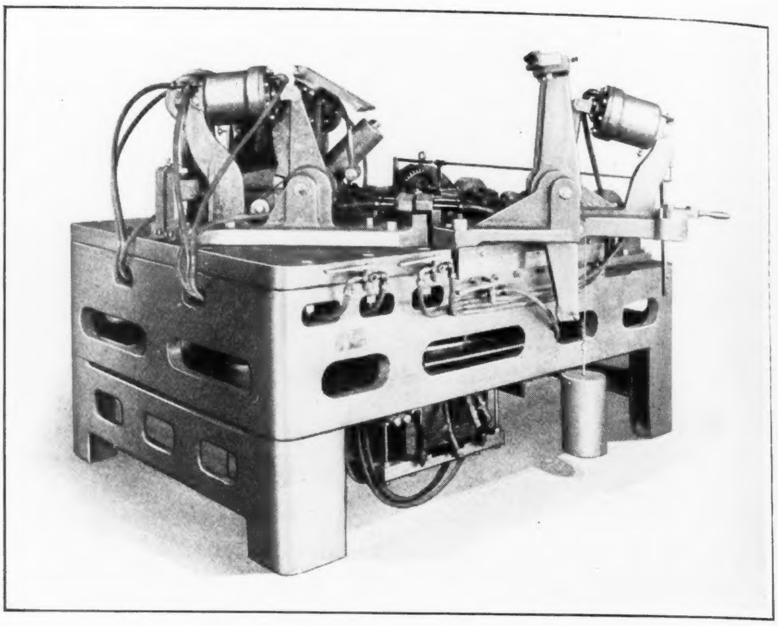
One of the switches, known as CR-3200-1250-A, is suitable for squirrel-cage motors that do not have an "overhauling" load. On hoists, for example, this switch can be used where worm-gearing or automatic mechanical load brakes are used. The CR-3200-1250-B switch is suitable for use where there is an overhauling load; that is, it can be used for hoists where a worm-gear or automatic mechanical load brake is not used. The CR-3202-1308-A switch is suitable for starting or speed-regulating duty, and is intended for use with 220-, 440- and 550-volt motors rated at 15 horsepower and less.

THOMSON ELECTRIC BUTT-WELDER

A No. 41 butt-welder designed primarily for use in welding sheet-metal automobile bodies is being placed on the market by the Thomson Electric Welding Co., Lynn, Mass. This machine has a capacity for welding automobile body stock 0.053 inch thick, in widths up to 54 inches. The accompanying illustration shows the machine provided with clamping equipment for welding a press-formed part of the cowl of an automobile to the formed front post for the windshield. In joining these parts, a weld approximately 13 inches long is made on each side. The joint or weld is made at an angle of approximately 45 degrees to the longitudinal axis of the welding machine.

The clamps on the right-hand platen are made in two separate units, and their brackets form two sub-platens which are mounted in such a way as to permit a 1/8-inch adjustment up and down, sideways, or backward and forward, to obtain the necessary accurate alignment of the welding dies. Each half clamp is adjustable independently of the other.

The clamps are of a combination hand- and air-operated type. The clamping jaws and levers are brought into position by hand, and the final clamping pressure is applied through the action of air cylinders controlled by valves located at the front of the machine. When the air pressure is released, the clamps are unlocked by hand, and counterweights then cause them to open. Special clamps for different kinds of work can be supplied to fit the machine frame.



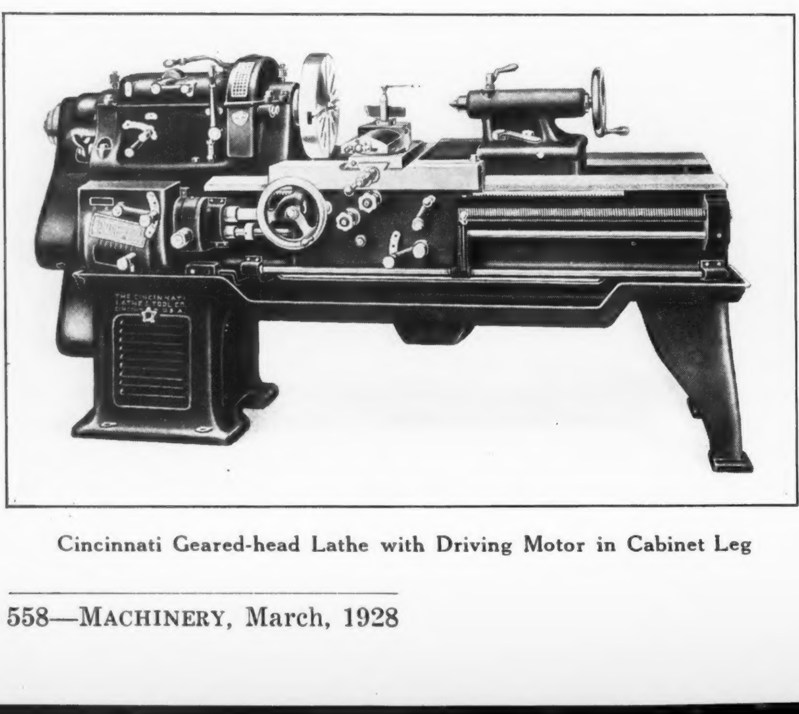
Thomson Butt-welder for Automobile Body Assemblies

The push-up and drive mechanisms are driven by a three-horsepower motor connected to a reduction gear unit which drives a shaft on which two actuating cams are mounted. The cams on the particular machine shown give a platen travel of 5/8 inch, but a greater travel can be provided for.

The transformer capacity is 200 kilovolt amperes, and is supplied by two separate 100-kilovolt ampere water-cooled transformers mounted beneath the welder frame. The weight of the complete machine is approximately 20,000 pounds.

CINCINNATI LATHES WITH NEW MOTOR DRIVE

Geared-head lathes driven by a motor located in a cabinet leg under the headstock are being introduced on the market by the Cincinnati Lathe & Tool Co., 3207-11 Disney St., Oakley, Cincinnati, Ohio. From the illustration it will be seen that there is a plate on the inside of the leg which can be removed to permit the installation of any required size and type of alternating- or direct-current motor. The lathes are furnished in 16-, 18-, and 20-inch sizes, equipped for either a silent chain or belt drive.



Cincinnati Geared-head Lathe with Driving Motor in Cabinet Leg

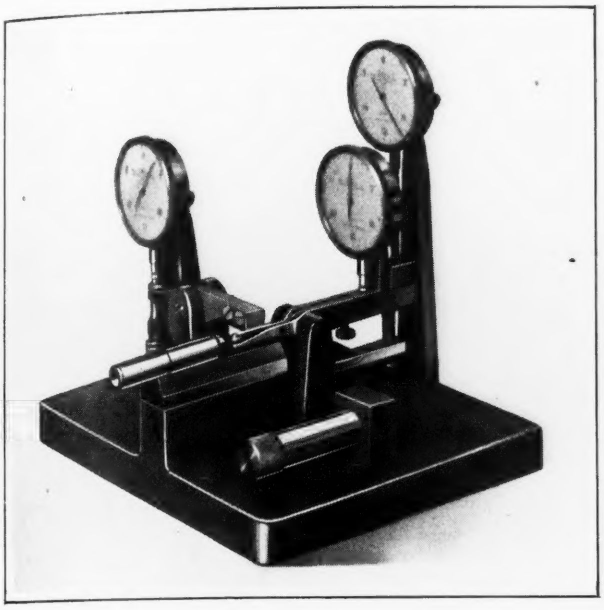
A patented quick-change gear-box which gives an unlimited range of threads and feeds is provided. Twelve spindle speeds are instantly available. An index-plate on the front of the head shows the lever position for each spindle speed. A plunger is provided for locking the spindle to facilitate removing chucks or faceplates without creating strains on the shafts or gears. The clutch is of the compression disk type. These lathes are supplied with or without oil-pans and in two-foot bed lengths.

AMES VALVE STEM BUSHING GAGE

A measuring instrument for inspecting valve stem bushings, which is shown in the accompanying illustration, is the latest special device to be brought out by the B. C. Ames Co., Waltham, Mass. This instrument checks the external diameter of the bushing, which has a tolerance of 0.0005 inch, the internal diameter, which also has a tolerance of 0.0005 inch, and the eccentricity of the internal diameter with respect to the external diameter. The instrument checks well within the tolerances.

The device is used as follows: The valve stem bushing is placed in the vee shown and pushed forward, encompassing the double lever which lies in the plane of the longitudinal axis of the bushing. Two dial micrometers are connected to this lever, one being mounted directly on the lever and the other on an upright extension from the instrument base. As both levers move, small errors due to wear of the locating surface are not introduced.

Two points of the double lever come in contact with the bore of the bushing, one with the top and one diametrically opposite, with the bottom. Because the dial gage is affixed to one lever and its spindle comes in contact with the other, absolute diameter measurements are obtained, and the measurement of the distance between the pointers, or the internal diameter, may be checked.



Ames Measuring Instrument for Valve Stem Bushings

When the valve stem bushing is revolved in the vee, if there is any eccentricity between the internal and external diameters, the entire double lever will move up and down. The dial gage measures this up and down movement, which is the eccentric relation between the diameters. The lever shown at right angles to the longitudinal axis of the valve stem bushing in the illustration is placed in contact with the outside of the bushing as it is pushed forward, and the third measurement is registered on the dial gage that is shown at the side of the instrument.

All settings are obtained by the use of a standard, and as this is a production measuring instrument, no adjustment is needed. Should the product to be measured vary in dimensions, however, adjustment can be provided for and the design can be altered so that standards are not required for settings, but size blocks or other measuring devices can be used instead.

The inspection time has been greatly reduced by the use of this instrument, for not only are three dimensions inspected at once, but the actual operation of inserting the part in the measuring position takes less time than any one of the three operations required by the old method. Such errors, for example, as ovality, bell-mouth, and taper may also be determined during the measuring process if required. Each dial is provided with a sector shutter which blocks off all the dial but the permissible tolerance. In reading the dial, the inspector merely looks for the arrow; if it appears, the part is passed; if it does not appear, it is rejected.

BROWN FLUSH-TYPE CASES FOR RECORDERS

The Brown Instrument Co., Wayne Junction, Philadelphia, Pa., has for a long time supplied its pressure gages, thermometers, and more lately its flow meters in flush-type circular cases. Now the company is also able to furnish the Brown continuous strip chart instruments in cases of the flush type, for flush mountings on switchboards or panels, the latter being pierced to receive the instrument cases.

A simple but important feature of the new flush type case is an arrangement by which the recording mechanism can be drawn out of the case at the front for easy inspection, after which it can be pushed back into place, a locking device holding it firmly in position. The instruments are supplied in single, duplex, multiple, or multiple duplex models, capable of producing from one to twelve records on one chart.

KEARNEY & TRECKER PRODUCTION MILLING MACHINES

Two sizes of the "Mil-Waukee-Mil" production milling machines, designated as the 1400 and 2200 series and made in six different lengths of table travel and bed are now manufactured by the Kearney & Trecker Corporation, Milwaukee, Wis. The general design of these machines was illustrated and described in October, 1927. MACHINERY. The machines in the 1400 series have a table 14 inches wide, while those in the 2200 series have a table 22 inches wide, and a wider and heavier bed. The machines in each series are offered with a table range of 3, 4, 5, 7, 9, or 11 feet, in either simplex or duplex types, giving a total of twenty-four separate models. The length of the bed under the table ranges from 4 to 16 feet, depending on the table length.

SPRINGFIELD GEARED-HEAD PRODUCTION LATHE

A geared-head production lathe equipped with Timken tapered roller bearings for the spindle has been brought out by the Springfield Machine Tool Co., 631 Southern Ave., Springfield, Ohio. All other bearings in the headstock are ball bearings. All gears are drop-forged, heat-treated, and run in oil. In place of the rapid change-gear device, this machine is provided with an instantaneous feed-box, which gives six changes of feed for each setting of the change-gears.

In place of a lead-screw, the machine is equipped with a power rapid-traverse screw, operated entirely from the front. A taper attachment, oil-

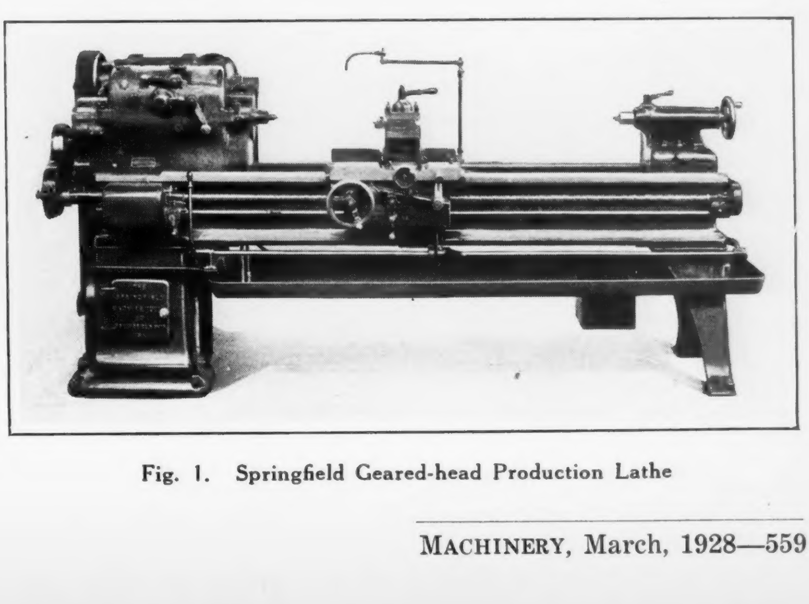


Fig. 1. Springfield Geared-head Production Lathe

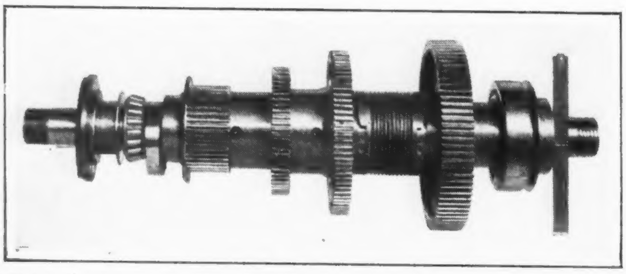


Fig. 2. Arrangement of Timken Bearings on the Spindle

pump, piping, and tubing are mounted on the rear of the lathe. There is an automatic stop on the feed-rod. While Fig. 1 shows the lathe equipped with a turret toolpost, this member can be interchanged with a compound rest or with any other type of tool-rest.

Specially selected precision-type Timken tapered roller bearings are furnished for the spindle. The thrust is taken up on the front bearing, which has ample adjustment to keep the spindle free from slack at all times. The company is prepared to mount Timken bearings on all sizes of lathes, and recommends this construction for production work, as it has a tendency to eliminate vibration and chatter. Also, in case of accident the bearings can be replaced promptly from stock.

SHAFER PILLOW BLOCK AND HANGER BOX

A self-aligning pillow block and hanger bearing containing a roller bearing with concave rollers have recently been placed on the market by the

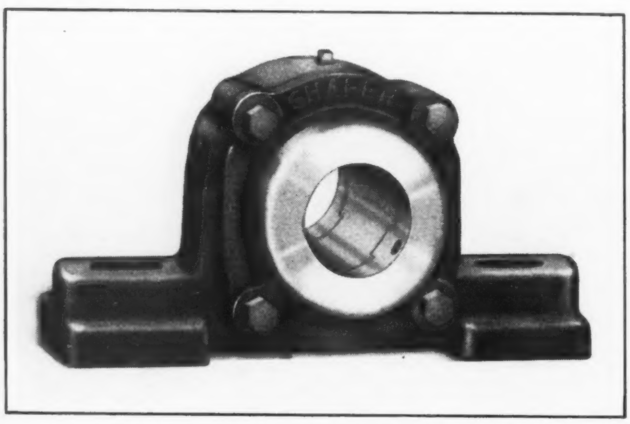


Fig. 1. Shafer Self-aligning Pillow Block

Shafer Bearing Corporation, 6501-99 W. Grand Ave., Chicago, Ill. In this bearing, the rollers are set at an angle between convex raceways, as shown in Fig. 2. The claim is made that the bearing combines advantages of ball and roller bearings. The rollers travel in alignment in relation to the cup and cone, and all climbing action is eliminated.

The radius of the rollers is slightly longer than that of the cup and cone, and the maximum load is carried at the center of the rollers, gradually decreasing toward the roller ends and thereby reducing slippage to a minimum. The cone, being a ball segment, is free to tilt in all directions, making it automatically self-aligning and eliminating any pinching and binding of rollers due to misalignment of machine parts or shaft deflection. Thrust and radial loads are carried on the same contact area of the rollers, eliminating double contact.

From Fig. 2 it will be seen that two separate cups and roller assemblies are opposed upon a one-piece spherical inner race. The inner race is extended on both sides and slotted to receive the collar tongues. Each collar is locked to the shaft by two headless set-screws which prevent any tendency of the race to creep. The mechanical labyrinth grease seal is used. It is self-aligning and maintains a uniform clearance regardless of shaft misalignment. This seal is designed to exclude all grit and dirt and eliminate all possibility of lubricant leakage, when filled with grease.

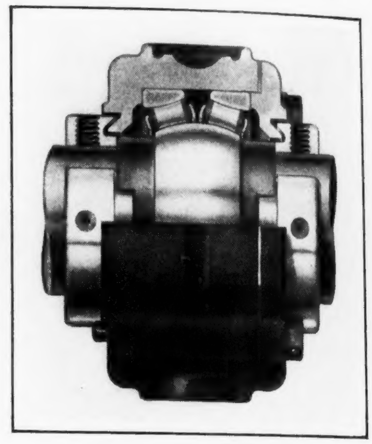


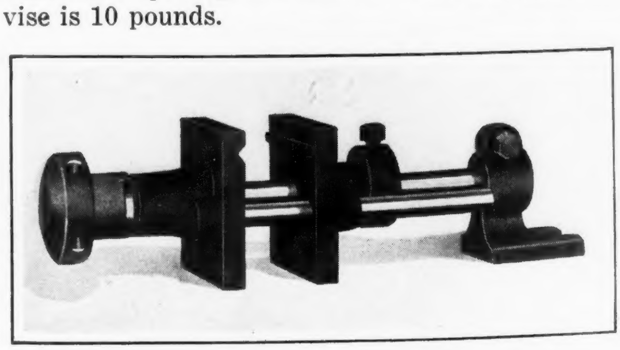
Fig. 2. Sectional View of Hanger Bearing

The hanger bearing can be used with practically any standard hanger, and as it is automatically self-aligning, there is no movement of the housing which would tend to loosen the supporting screws of the hanger. The self-aligning pillow block is compact, is of rugged design, and is offered for machine applications as well as for general industrial equipment. Both the bearing and pillow block are made for shafting from 1 3/16 to 2 15/16 inches in diameter.

MILLER & CROWNINGSHIELD DRILLING MACHINE VISE

A No. 1 vise intended for application to drilling machines is being placed on the market by Miller & Crowningshield, Greenfield, Mass. The jaws are square on all sides, so that any side can be firmly located on the machine table. Round, square, or hexagonal rods can be held in the proper positions for endwise or crosswise drilling. The rear jaw is slidable and can be clamped in any position. The work is clamped by turning the knob-shaped nut at the front jaw. The guide bars form a convenient base on which to rest the work while drilling.

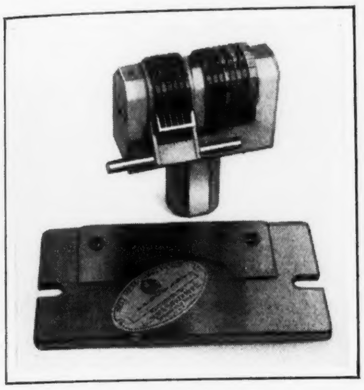
A shoulder on one jaw forms a stop or rest for locating small pieces. When necessary, the casting at the right of the vise, as seen in the illustration, can be bolted to the machine table. The jaws are 3 1/2 inches wide, 3 1/2 inches high, and have a maximum opening of 6 inches. The weight of the vise is 10 pounds.



Miller & Crowningshield Vise for Drilling Machines

NOBLE & WESTBROOK DOUBLE NUMBERING HEAD

The latest special numbering head to be produced by the Noble & Westbrook Mfg. Co., 20 Westbrook St., East Hartford, Conn., is of double design. It was made for numbering nameplates of the style shown beneath the numbering head in the accompanying illustration. The six wheels on the left-hand side of the numbering head operate automatically for serial numbering, while the wheels on the right-hand side mark such information as a catalogue number, model number, date, etc. The wheels on the right-hand side are changed by hand as required.



Special Numbering Head

Between the two sets of wheels there is a segment stamp or star design, which is inserted directly into the central support. The central support strengthens the device.

"THOR" ROTARY GRINDERS AND SANDERS

A new line of "Thor" rotary air grinders and sanders has recently been placed on the market by the Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill. In these tools, the motor is of light design and carries four balanced bakelite blades which are unaffected by oil, water, or heat. It is mounted on a shaft suspended in ball bearings. The spindle is also suspended and held in alignment by ball bearings at each end.

The governor is adjustable and fully enclosed. It keeps the free-speed air consumption low until the wheel is applied to the work, at which time it automatically throttles to the speed and air required for the job. There is an automatic oiler which carries sufficient light oil to lubricate all moving parts for eight hours. A muffler is incorporated in the box-like lug on the spindle support.

Fig. 1 shows the grinder, and Fig. 2, the sander. The No. 271 grinder weighs only 15 1/2 pounds, and is 21 1/4 inches long over all. It has a straight-handle throttle and a speed of 4000 revolutions per minute. This grinder is equipped with a 6-inch emery wheel having a face width of 1 1/2 inches. The No. 272 grinder weighs 17 1/4 pounds, and is

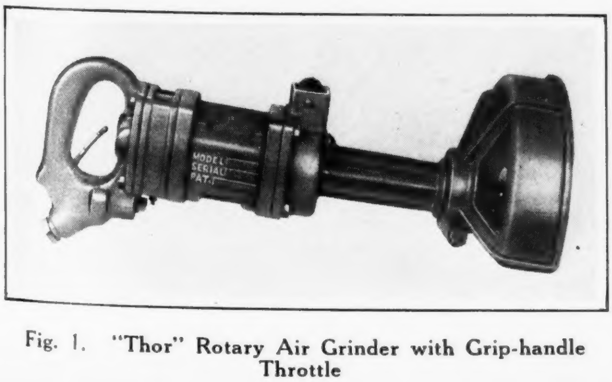


Fig. 1. "Thor" Rotary Air Grinder with Grip-handle Throttle

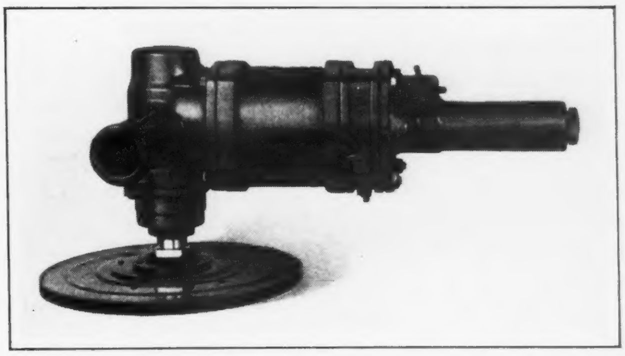
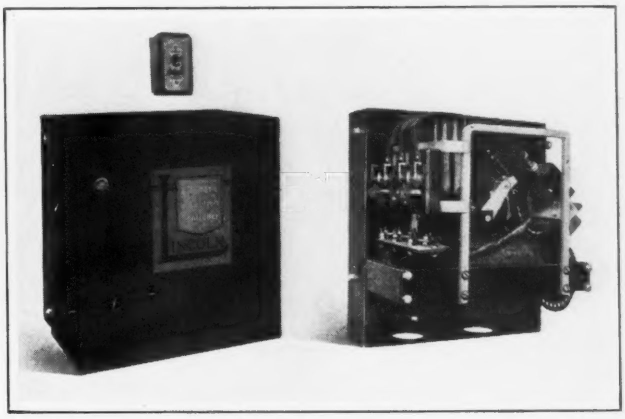


Fig. 2. "Thor" Rotary Air Sander with Flexible Disk

19 3/4 inches long over all. This grinder has a grip-handle throttle, as shown in Fig. 1, and a speed of 3200 revolutions per minute. It carries an 8-inch emery wheel having a face width of 1 1/2 inches. The No. 271 R sander has a right-angle housing of the construction illustrated in Fig. 2. The length of this device over all is 14 inches, and the speed is 4000 revolutions per minute. It carries flexible disks up to 9 inches in diameter.

LINCOLN AUTOMATIC STARTER

An automatic induction starter with two adjustable features is being introduced to the trade by the Lincoln Electric Co., Coit Road and Kirby Ave., Cleveland, Ohio. In this starter, the starting current and starting torque are adjustable by changing the position of the rotor in the regulator. The rotor is index-mounted, and the starting torque and starting current are increased by going to



Lincoln Automatic Induction Starter

higher numbers of the scale, and decreased by going to lower numbers.

The current that governs the point at which the throw-over takes place is also adjustable. The throw-over is controlled by retarding the solenoid, which is operated by the motor current. The pull of the solenoid can easily be adjusted.

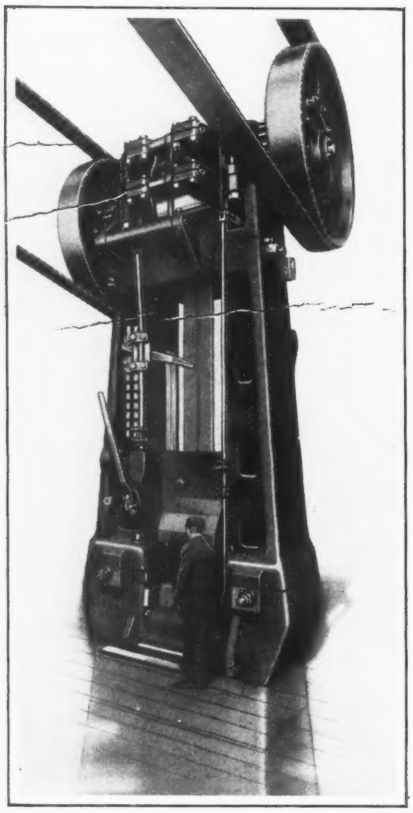
With this automatic induction starter, the motor is controlled by conventional start- and stop-buttons. When the start-button is compressed, it applies the correct voltage to the motor and the starting current is held within the desired limits. After the motor comes to speed, the current attained falls off. When it has fallen off the desired amount, the switch automatically sets itself in the running position without interrupting the torque of the motor.

The motor is removed from the line by pushing the stop-button.

The starter can be mounted with unusual ease. For mounting purposes, it may be considered as consisting of three parts, the back cover, front cover, and the switch itself. Overload protection is afforded by thermo-relays, and no-voltage protection by a no-voltage release control.

BILLINGS & SPENCER LARGE-SIZE BOARD DROP-HAMMERS

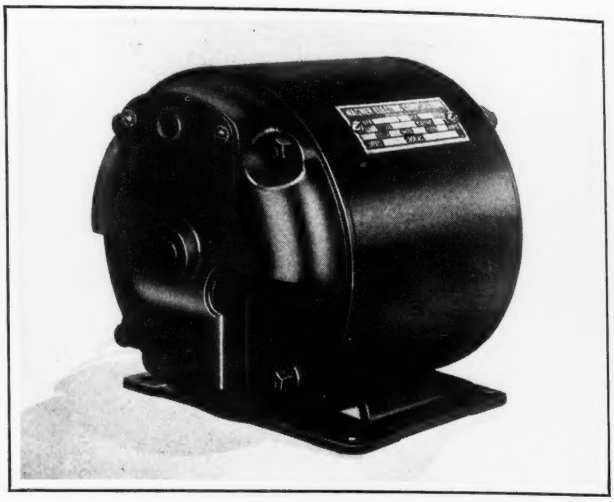
Board drop-hammers have recently been placed on the market by the Billings & Spencer Co., Hartford, Conn., in sizes ranging from 4000 to 7500 pounds. One of the difficulties heretofore experienced in building large-sized board hammers has been to secure sufficient lifting action on the board to lift the heavy ram. In the new model E hammers, this difficulty has been overcome by using two sets of rolls, one above the other, and equalizing their lifting action by a system of levers. Thus, excessive pressure on the board is eliminated and no increase in board width is necessary, resulting in a well-proportioned ram and a proper distance between uprights.



Board Drop-hammer of Large Size

The action of the hammer is automatic, so that "treadling" each blow is unnecessary. As long as the operator holds his foot on the treadle, the ram continues to strike from 55 to 60 blows per minute. The operator is thus relieved of the strain placed upon him when "treadling" for each blow. Uniform output, both in size and internal structure of the work, is maintained, as every blow is of equal force.

"Fullering" or edging may be done on the new hammers without danger of destructive stresses, When a blow is struck with a piece well off the center of the die, such as in the preliminary bending of a crankshaft, the resultant "twist" is entirely taken up on the guides, as the board is free to play crosswise between the rolls. The knock-off constitutes an interesting improvement, this device providing an adjustment to allow the hammer to work equally well on thin or thick dies. Friction adjustment can be made on the rolls from the floor by means of a one-roll adjusting bar at the back of the hammer, which controls both rear eccentrics.



Wagner Induction Motor Equipped with Improved Switch

WAGNER SPLIT-PHASE MOTOR

A type 58-RB split-phase induction motor made in 1/8-, 1/6- and 1/4-horsepower sizes has recently been brought out by the Wagner Electric Corporation, 6400 Plymouth Ave., St. Louis, Mo. An outstanding feature of this motor is the switch, which is said to be capable of starting and stopping the motor more than 500,000 times. One motor has already been started and stopped nearly 1,000,000 times without the switch showing any sign of breakdown.

This switch is so constructed that the contact is broken instantaneously, without dragging. The starting time is never prolonged beyond that required for proper control of the motor. The wiping contact is obtained without undue wear, and the switch parts will not rust, stick, or bind. Other improvements embodied in the motor are a new method of oiling, a heavy formed-steel base, drip-proof end-plates, and an accessible terminal, well insulated to prevent grounding.

THOMPSON CUTTER AND REAMER HOLDER

An improved cutter and reamer holder, together with a tailstock, is now included with all universal equipment for the standard 12- by 36-inch universal grinding machine built by the Thompson Grinder Co., Springfield, Ohio. This cutter and

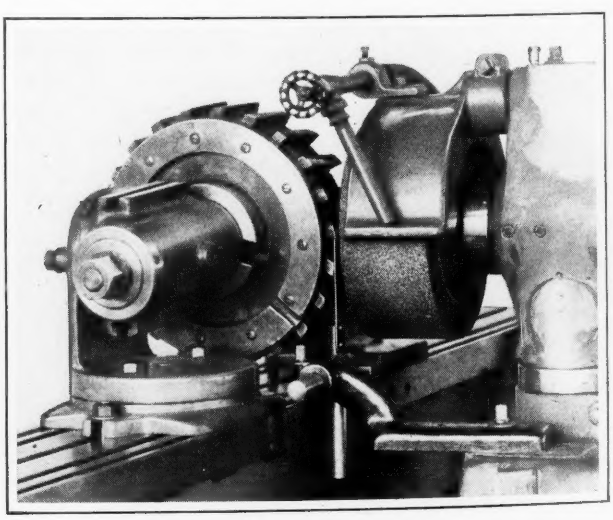


Fig. 1. Thompson Cutter and Reamer Holder being Used in Grinding a Milling Cutter

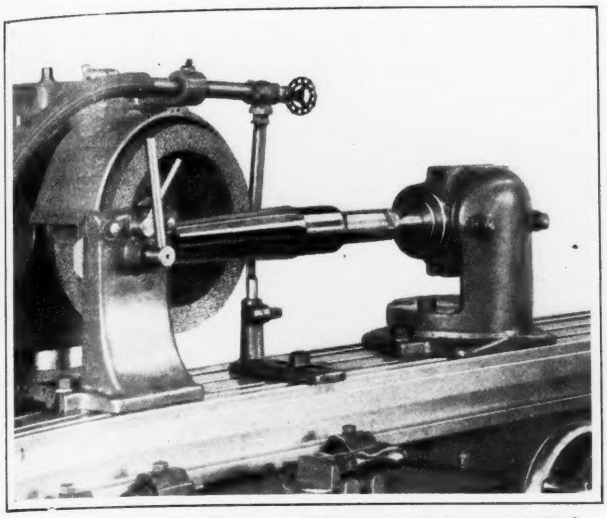


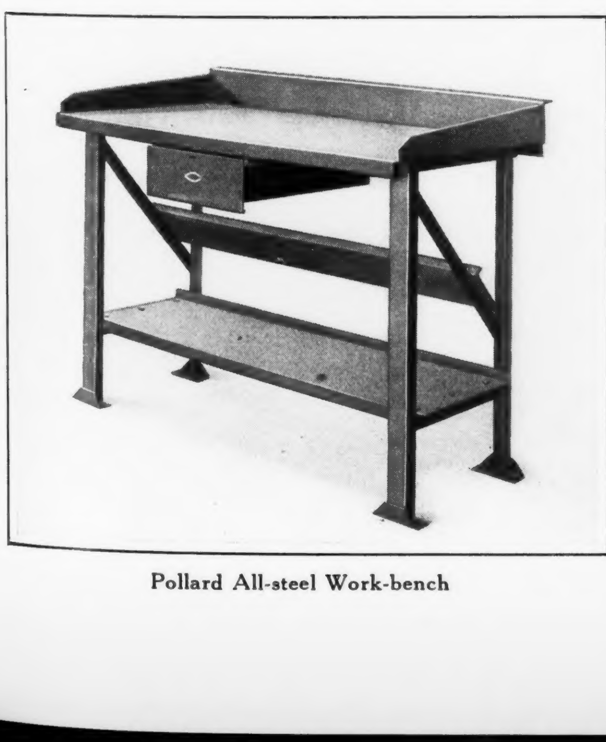
Fig. 2. Using the Cutter and Reamer Holder and Tailstock in Sharpening a Reamer

reamer holder has a capacity for milling cutters up to 12 inches in diameter, and may be used with cutters having either straight or spiral teeth. When mounted on this holder, a cutter can be swiveled through a vertical plane and also through a horizontal plane, as will be apparent from Fig. 1. The holder is used in conjunction with a cup-wheel, so that the angular clearance surfaces on cutter teeth are ground flat.

The tailstock is used as shown in Fig. 2, when reamers are ground on centers. Reamers from 1/2 to 12 inches in diameter and up to 36 inches long can be accommodated. The tailstock is designed to permit free passage of the cup-wheel without interference on the smallest reamers. There is a quick-action sliding movement of the center, and a quick-action clamp for locking it in position. The headstock is equipped with the new standard spindle end recently adopted by milling machine manufacturers. It can be provided with collets to fit various sizes of tapered or straight shanks on reamers and arbors.

POLLARD ALL-STEEL WORK-BENCHES

A complete line of all-steel work-benches has been placed on the market by the Pollard Bros. Mfg. Co., Inc., 4034-36 N. Tripp Ave., Chicago, Ill.



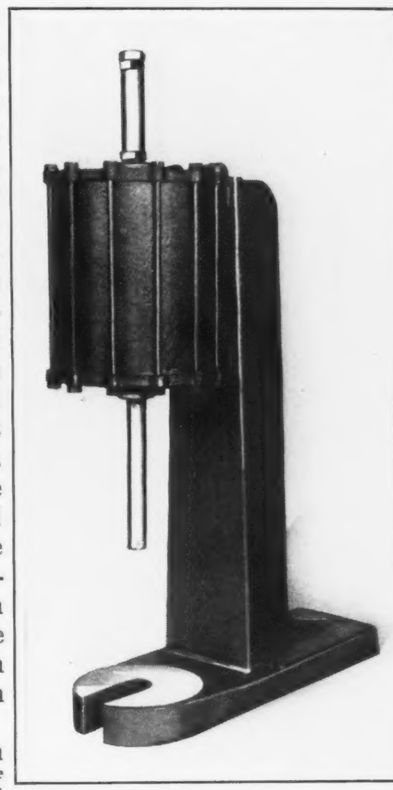
Pollard All-steel Work-bench

The illustration shows one of the line. These benches are made in several different lengths, widths, and heights. The standard lengths are 3, 4, 5, 6, 8, and 9 feet. The widths vary according to common practice, and are 24, 29, 32 1/2, and 46 inches. The heights vary from 25 to 35 inches, according to customers' specifications, but the standard heights of bench legs are 30, 32 1/4, and 35 inches.

The bench tops are made of 1/8-inch steel. End and back plates act as a safeguard against things sliding off. The benches can be furnished with a shelf as illustrated. Standard drawers, are installed by the aid of special clamps.

LOGANSPORT AIR-OPERATED ARBOR PRESS

An air-operated arbor press in which the piston of the air cylinder is mounted direct on the ram was recently built by the Logansport Machine Co., 529 Market St., Logansport, Ind. The construction of this equipment, as shown in the accompanying illustration, differs primarily from the standard "Logan" design in that there are no levers between the air cylinder and the ram. The special construction was made because a 10-inch stroke was required, and this would have made a cumbersome design necessary if the standard system of levers had been adhered to.

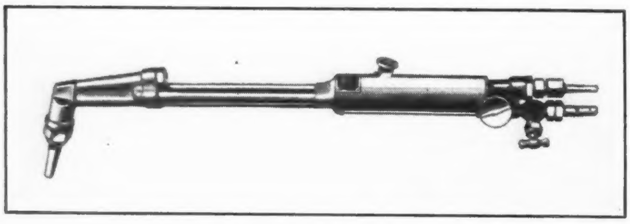


Logansport Air-operated Arbor Press

A maximum ram pressure of 6280 pounds is produced by the special arbor press, with an air pressure of 80 pounds per square inch. When the piston is at the upper end of its stroke, the top end of the ram is enclosed in a tube mounted on the cylinder. The entire design is compact and simple, but, of course, a larger size of cylinder is required to obtain the desired pressure than is necessary when levers are employed.

OXWELD CUTTING BLOWPIPE

A cutting blowpipe known as the type C-14, which is claimed not to back-fire even under the most severe operating conditions, has been added to the line of the Oxweld Acetylene Co., 30 E. 42nd St., New York City. This blowpipe uses the same nozzles as the type C-2 which it resembles, although several improvements in design have been made.



Oxweld Type C-14 Cutting Blowpipe

The three gas tubes are straight, having no bends either outside or inside of the handle. The cutting valve is of the same design as is used on the type C-6 blowpipe.

The head, rear body, and the small needle valve bodies are pressure forgings. Interchangeable nozzles are provided, so that the blowpipe can be used with either medium- or low-pressure acetylene. The medium-pressure nozzle cannot be used with low-pressure acetylene, but the low-pressure nozzle can be used with a medium-pressure acetylene supply if low pressure is maintained in the hose and blowpipe.

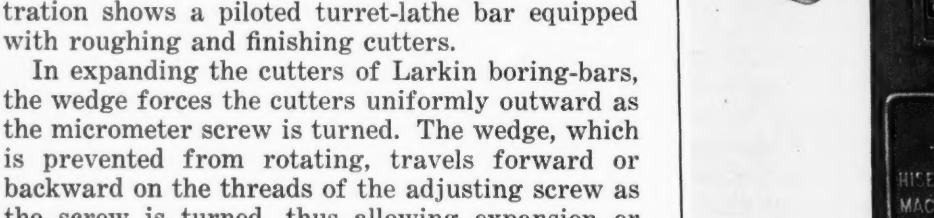
LARKIN EXPANSION BORING-BARS

Expansion boring-bars are being placed on the market in various sizes and styles by the Larkin Packer Co., 6200 Maple Ave., St. Louis, Mo. The expansion units of these bars have a wide range of cutter expansion, and are composed of only four main parts—an adjusting screw graduated to 0.001 inch, a wedge threaded on the adjusting screw, a thrust collar, and a removable bushing. The illustration shows a piloted turret-lathe bar equipped with roughing and finishing cutters.

In expanding the cutters of Larkin boring-bars, the wedge forces the cutters uniformly outward as the micrometer screw is turned. The wedge, which is prevented from rotating, travels forward or backward on the threads of the adjusting screw as the screw is turned, thus allowing expansion or reduction of the cutter diameter to any size within the range of the tool. The adjusting screw does not travel while rotating, being confined in a fixed position at the head. The thrust at the bottom is taken up by the hardened and ground thrust collar, which serves as a centering unit for the conical point of the adjusting screw. It also serves to support the adjusting screw on center. The entire expansion unit is fitted in place from the front of the bar, and is retained by the removable bushing which gives access to adjustable parts.

A simple method of locking the cutters in place is employed. There is an eccentric locking screw which employs a positive cam movement to clamp each cutter in its slip-fit slot. To provide a quick method of removing the cutters, the head of the locking screw has an indicator mark at zero, which is located at the point where cam pressure is released from the cutter. Each cutter is held independently, right- and left-hand threads throwing the locking movement inwardly against the wedge.

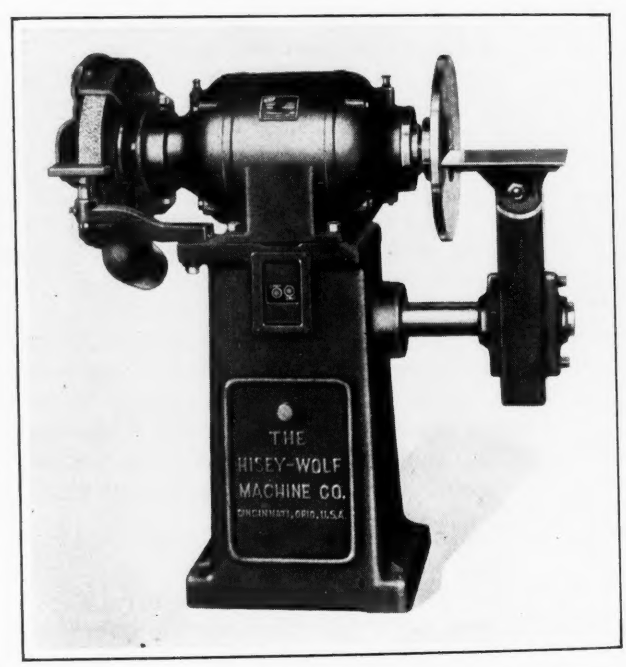
All cutters are made to standard dimensions. When worn under size beyond the expansion range of one bar, they can be used in smaller diameter bars having the same slot dimensions. These boring-bars are made in ten stock styles and sixteen stock sizes, ranging from 1 1/4 to 6 inches in body diameter, for various operations on almost any type of machine. In addition, there are standard types of bars for boring car wheels, locomotive driving-boxes, driving rods, rod brasses, etc. Special boring-bars can be made to meet individual needs.



Larkin Expansion Boring-bar for Turret Lathe

HISEY COMBINATION DISK AND FLOOR-STAND GRINDER

A combination disk and floor-stand grinder driven by a 3 1/2 horsepower motor has been brought out by the Hisey-Wolf Machine Co., Cincinnati, Ohio. The spindle of this machine is mounted in two ball bearings which take radial loads only. A double-acting self-aligning thrust bearing is provided to take end thrust.



Hisey Combination Disk and Floor-stand Grinder

The plain work-table illustrated measures 8 1/4 by 9 1/2 inches. A universal lever-feed table, 6 1/2 by 13 inches in size, can also be furnished. Standard equipment includes a combination wheel guard as shown, a 15-inch diameter steel disk, a plain work-table, and an automatic safety motor starter. Either alternating- or direct-current motors can be furnished.

TEMPLETON-KENLY SCREW JACKS

A new line of "Simplex" screw jacks embracing thirty-two sizes and rang-

Templeton-Kenly Screw Jack

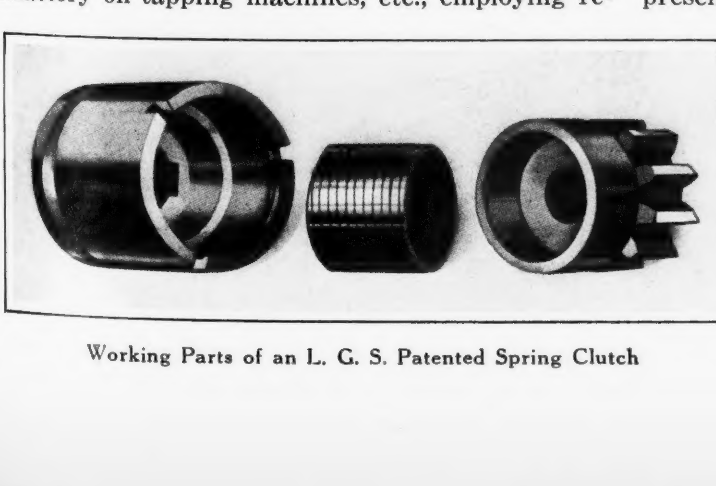
ing in capacity from 5 to 36 tons has been brought out by Templeton, Kenly & Co., Ltd., 1020 S. Central Ave., Chicago, Ill. Instead of having a solid frame, the new jacks have a frame in which there is a hand-hole directly under the carrying handle, as shown in the accompanying illustration. This permits the workman to observe the position of the screw at any time. A "Duco" finish of different color is applied to each size to facilitate identification. The screw and head are forged from one piece of steel. The height of the 5-ton jack, when closed, is 8 inches, and of the 36-ton jack, 29 inches.

L. G. S. SPRING CLUTCHES

Spring clutches for a variety of applications are being introduced on the market by the L. G. S. Mfg. Co., 26th and Cornell Ave., Indianapolis, Ind. The various applications require slight adaptations, but all the clutches have only three working parts. Reading from left to right in the accompanying illustration, these working parts consist of a driving member, spring connecting link, and driven member. Operating within the recesses of the driving and driven members, the smooth-surfaced spring connecting link expands or contracts under friction, according to the direction in which the mechanism is turned. Thus a right-hand turn makes a positive connection and causes the driven member to revolve, while a left-hand turn releases the pressure so that the driving member runs free.

Three general types of clutches are made—a ratchet type, manual type, and centrifugal type. The ratchet type may be freely rotated in one direction, but automatically engages when rotated in the opposite direction; the manual type must be thrown into and out of engagement by the operator; and the centrifugal type is automatically thrown in and out at certain speeds, as may be required by the machine in which it is installed.

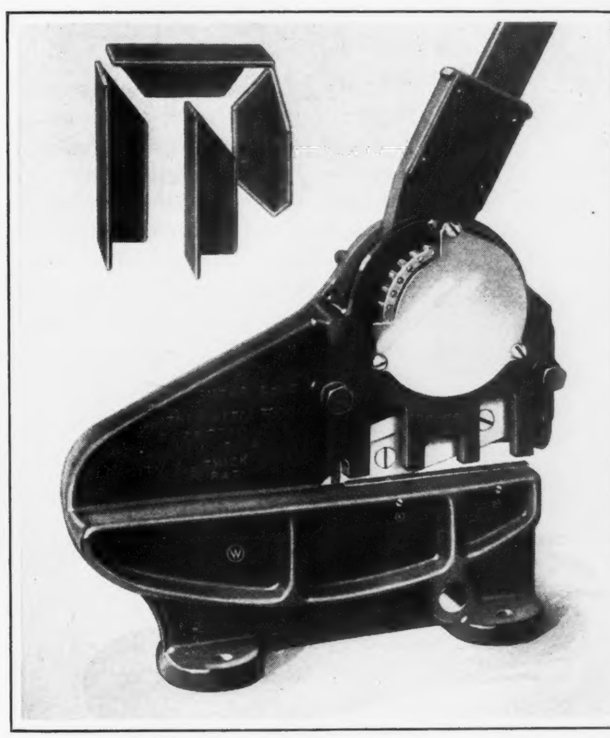
Double ratchet clutches have been applied to punch presses and other machines working on roll material, as they can be minutely adjusted with reference to the amount of stock fed at each operation. The manual clutches are particularly satisfactory on tapping machines, etc., employing reversing mechanisms. The centrifugal clutch is suitable for use in connection with motor-driven air compressors, water pumps, and other machinery having a high starting torque. Wrenches are also made by the company which incorporate the principle of the spring clutch.



Working Parts of an L. G. S. Patented Spring Clutch

WHITNEY SLITTING SHEAR

A No. 6 slitting shear that has a shearing capacity up to and including 3/16-inch thick material, has recently been added to the punch and shear line of the Whitney Metal Tool Co., Rockford, Ill. This shear is made largely of alloy-steel drop-forgings, and all wearing parts are hardened. The eccentric crankpin and trunnion bearings are roller bearings. The shear is throatless. The shearing blades are 4 1/4 inches long and are of the inserted type. The lower shearing blade is adjustable, thus providing a means of taking up wear.



Whitney Slitting Shear with a Capacity for Shearing Material up to 3/16 Inch Thick

MACHINE SHOP PRACTICE MEETING OF CHICAGO SECTION, A. S. M. E.

On March 14, the Chicago Section of the American Society of Mechanical Engineers will hold its annual machine shop practice meeting at the Morrison Hotel in Chicago. Among the papers to be presented are the following: "Development of Fully Enclosed Gear Drives for Industrial Speed Reduction," by J. A. Marland, W. A. Jones Foundry & Machine Co., Chicago, Ill.; "Special Machinery for Mass Production," by H. L. Blood, Western Electric Co., Chicago, Ill.; "Stopping Production Leaks Through a Simplified Production Control," by K. R. Wood, production manager, Bell & Howell Co., Chicago; "Relation of Chromium Plating to Industries," by J. Becker, chief research chemist, Vacuum Can Co., Chicago.

Faster machines mea

It will pay you to apply these cost cutting features in your shop—

The Swing Stop

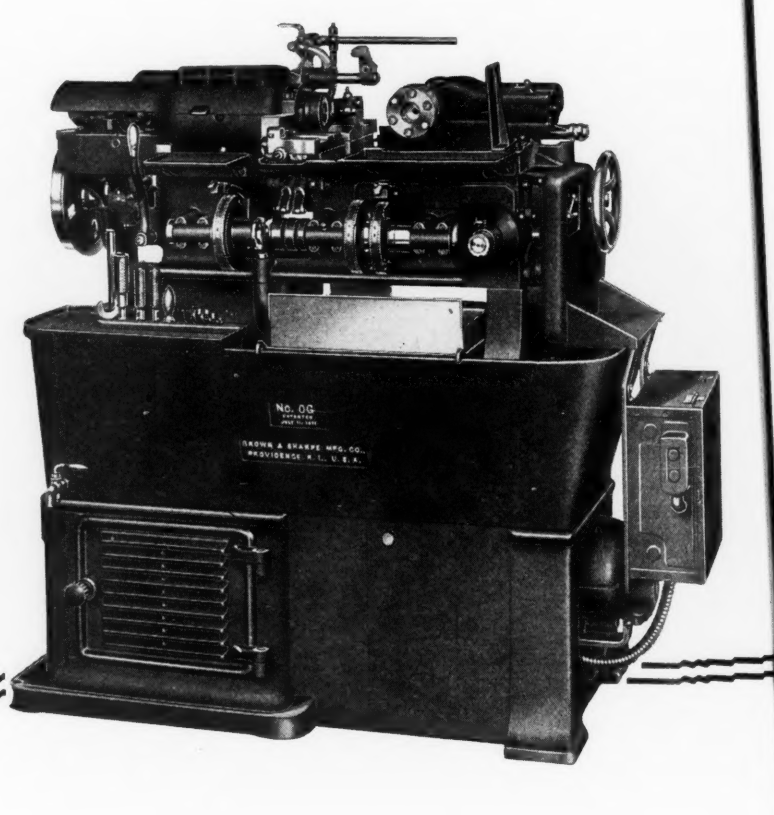
The swing stop for stock has proved a valuable time saver. It swings into position just previous to the advance of the bar, eliminating the need for a stock stop in the turret and making all six holes available for operating tools. On work requiring but one turret operation in conjunction with the cross slide tools it is not necessary to index the turret, since the swing stop controls the length of stock fed. When a job requires but three turret positions, the swing stop makes possible the use of two complete sets of tools in the turret, thereby producing two finished pieces with each turret revolution.

Double Indexing

The double indexing feature enables indexing two positions at once, in the same time required to index one position by single indexing. Thus, on jobs requiring three turret positions, one set of tools can be used, two positions indexed at a time and the same rate of production obtained as by using two sets of tools and single indexing.

Higher Spindle Speeds

Increased spindle speeds and the fast backshaft, which speeds up the cross slide and turret movements, enable faster production.



still lower costs—

Brown & Sharpe High Speed Automatics

THE Brown & Sharpe High Speed Automatic Screw Machines are designed to handle chiefly the free-cutting metals such as brass and aluminum, and small parts of iron and steel. Remarkable production records have been made by taking advantage of the higher spindle speeds (up to 5000 R.P.M.) and the other important construction features.

The savings which these machines effect wherever they are installed prove an important item in lowering manufacturing costs.

Our representatives are always ready to tell you about the High Speed Automatics. Also, remember that our Screw Machine Engineering Service is available for your use at any time. Take advantage of the broad experience of the men who have designed and built thousands of Screw Machine production set ups.

Brown & Sharpe Products

Milling Machines
Grinding Machines
Gear Cutting Machines
Screw Machines
Cutters and Hobs
Machinist's Tools
Gears Cut to Order

BROWN & SHARPE

BROWN & SHARPE MFG. CO. B·S PROVIDENCE, R. I., U. S. A.

THE BRITISH METAL-WORKING INDUSTRIES

From MACHINERY'S Special Correspondent

London, February 15, 1928

The present year has opened satisfactorily as far as the British metal-working industries are concerned, and on all sides a note of quiet optimism prevails. It is true that no boom period is anticipated, but at the same time it is felt that industry generally is definitely on the up grade.

Since the beginning of January a steady fall in the number of unemployed has been recorded, the latest figures available showing that on January 23 the total number of unemployed was 1,178,700, a decrease of 15,100, as compared with the figure for the previous week, and 170,000 less than a year ago. Of the total no less than 207,300 is accounted for by unemployed miners. It is impossible to note any definite improvement in the coal mining industry; nor is it possible to regard the future of this industry with any great degree of optimism, more particularly in view of the fact that crude oil is rapidly replacing coal for many purposes.

One of the brightest features of the industrial outlook at the present time is the movement toward peace in industry, and there appears to be little doubt that both employers and employed are definitely anxious to establish better relations than have hitherto prevailed.

Olympia Exhibition Promises to be of Record-breaking Size

Although the quadrennial Machine Tool and Engineering Exhibition organized by the Machine Tool Trades Association does not open until September 5, almost the whole of the ground floor space of Olympia and a large portion of the gallery has already been let. The demand has been greater than on any previous occasion, and Sir Alfred Herbert, the president of the association, is of the opinion that the exhibition will constitute a record as regards the number of machine tools, woodworking machines, small tools, and accessories that will be shown, and also as regards progress in design.

Increase in Prices Expected in Machine Tool Industry

Sir Alfred Herbert also foretells a steady improvement in this industry during the year, with some advance in prices. In many instances, during the past years of depression, prices have been cut down to an unremunerative level on account of the keen competition which has existed. The result of an upward trend of prices will be to put the industry on a healthier footing, so that machine tool makers will be better able to develop new machines to meet the ever changing needs of modern mass manufacture.

Overseas Trade in Machine Tools Shows a Falling Off

The figures for overseas trade in machine tools during December show a marked falling off, compared with the previous month, but this may be largely attributed to the holidays. Exported tonnage fell from 2018 tons to 969 tons, with a corresponding fall in value from £197,581 to £113,318. There was, however, some improvement in export ton value, the figure having risen from £98 to £117.

Imports also showed a decrease in tonnage, the figure being 595, as compared with 803 in October and 707 in November. The value of imports was £89,894 as compared with £113,804 in October and £109,180 in November. Here, again, the ton value showed a slight decrease, dropping from £154 in November to £151. The value of tools and cutters exported in December was £51,906, as compared with £59,231 in October and £60,003 in November.

Shipbuilding Industry Has Had Satisfactory Year

Complete figures are now available for the output of ships from British yards during 1927, and these figures cannot but be regarded as eminently satisfactory. The total tonnage launched during 1927, namely, 1,225,873 tons, represents an increase of 586,305 tons over the figure for the previous year. Great Britain's total for 1927 represented 53.6 per cent of the world's output. The 1926 output of 639,568 tons was 38.2 per cent, and the 1925 output of 1,084,633 tons, 49.5 per cent of the world's total. During 1927, eighty-six vessels of between 5000 and 10,000 tons and seven vessels of 10,000 tons and upward were launched in this country.

Low Profits Reported in Iron and Steel Industry

During the past year over nine million tons of steel were produced in this country, a figure which has only twice been exceeded—in 1917 and 1918. In spite of this large output, the position in the industry has been far from satisfactory, prices having been reduced so much as to show little, if any, margin of profit.

British iron and steel makers have succeeded in reducing their costs until their prices are only from 15 to 20 per cent above pre-war level, but foreign iron and steel has been cheaper still, and British re-rollers have relied largely on Continental supplies. As a result, more than four million tons of iron and steel were imported during 1927, a figure somewhat in excess of the exported tonnage.

The capacity of British steel works was increased by about 50 per cent, as compared with the early years of the war, and herein lies the chief reason for the present depression. Continuity of operation is essential to the economical production of steel, and when it is appreciated that the 1927 output represents only about 75 per cent of capacity, the difficulties under which British steel makers labor will be readily understood. However, the present year has opened well and, with few exceptions, British steel makers are better employed than during the closing months of 1926.

Activity Evidenced in Automobile Industry

Automobile manufacturers are well employed, and those producing light six-cylinder cars are especially busy. There would appear to be every prospect of a record output of cars in this country during 1928. Those who profess to regard the motorcycle owner merely as a prospective car owner cannot fail to be surprised at the rapid growth of the motorcycle industry in this country. And there can be little doubt that the motorcycle manufacturer is assured of a large and permanent market among individuals who definitely prefer this means of transportation.

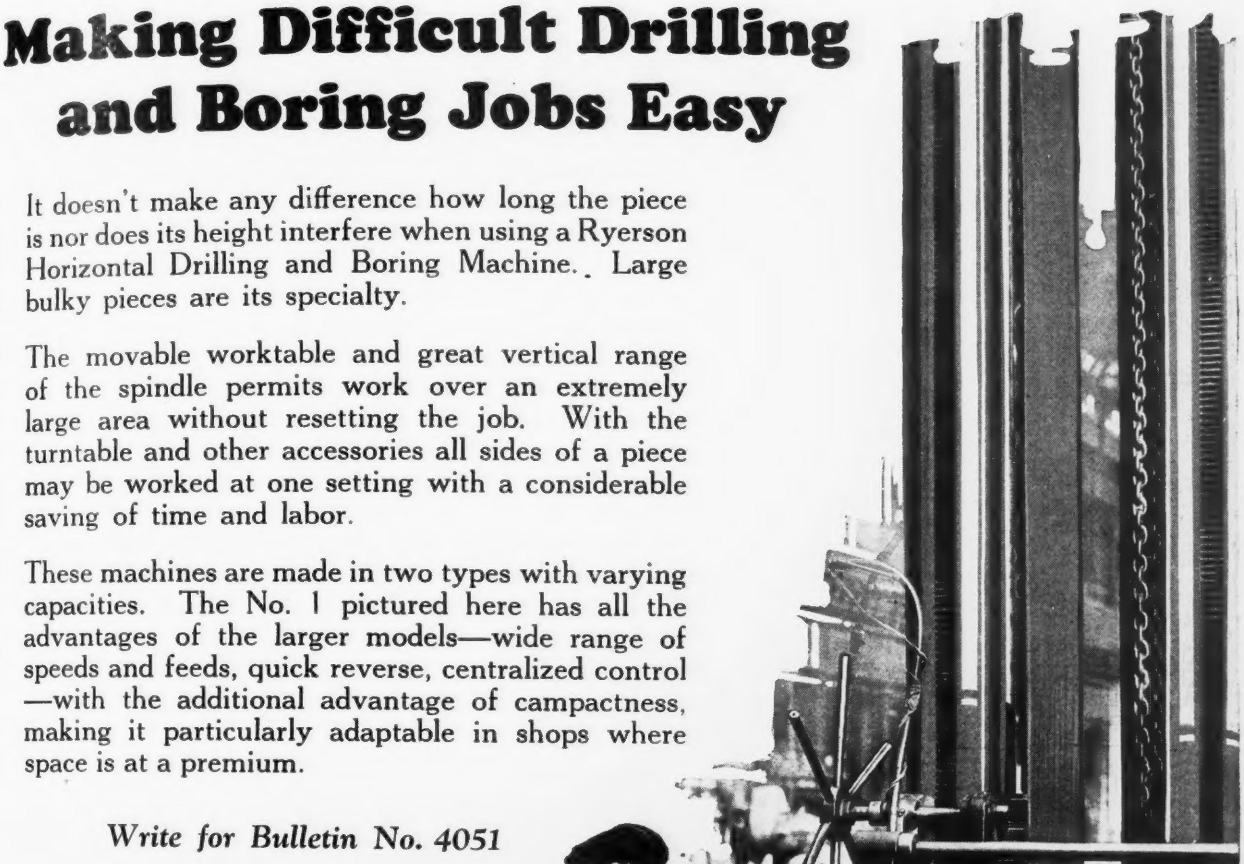
Making Difficult Drilling and Boring Jobs Easy

It doesn't make any difference how long the piece is nor does its height interfere when using a Ryerson Horizontal Drilling and Boring Machine. Large bulky pieces are its specialty.

The movable worktable and great vertical range of the spindle permits work over an extremely large area without resetting the job. With the turntable and other accessories all sides of a piece may be worked at one setting with a considerable saving of time and labor.

These machines are made in two types with varying capacities. The No. 1 pictured here has all the advantages of the larger models—wide range of speeds and feeds, quick reverse, centralized control—with the additional advantage of campactness, making it particularly adaptable in shops where space is at a premium.

Write for Bulletin No. 4051



JOSEPH T RYERSON & SON INC.

Established 1842

Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Pittsburgh, Philadelphia, Boston, Jersey City, New York, Richmond, Houston, Tulsa, Los Angeles, San Francisco, Denver, Minneapolis, Duluth

RYERSON

MACHINERY-SERVICE

Lathes	Grinders	Punches	Bulldozers	Presses and Brakes
Drills	Milling Machines	Shears	Bending Rolls	Serpentine Shears
Planers	Horizontal Drills	Small Tools	Arc Welders	Flue Shop Equipment
Shapers	Riveters	Friction Saws	Butt Welders	Spring Shop Equipment

PERSONALS

ROBERT M. REINHOLD has been appointed manager of the industrial department of the Business Training Corporation, 347 Madison Ave., New York City.

O. D. FRIES has been appointed salesman of the Lincoln Electric Co., Coit Road and Kirby Ave., Cleveland, Ohio, in charge of consumer motor business in the Detroit territory.

A number of important changes in personnel have been made by the Westinghouse Electric & Mfg. Co., East Pittsburg, Pa. E. C. BRANDT and F. J. SHIRING have been appointed assistant works managers, and J. E. WEBSTER has been appointed chief plant engineer. Announcement is also made of the appointment of A. E. KAISER as director of production for all works, and of S. C. HOEY, as works manager of the Homewood Renewal Parts Works.

E. C. Brandt

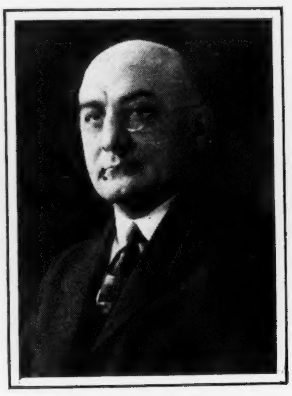
F. J. Shiring

Mr. Brandt has been connected with the company since 1905, and has held the position of works manager of the Homewood Works since 1922. Mr. Shiring began his employment with the company in 1894 as a production and time clerk in the railway department. He was steadily advanced until, in 1926, he became superintendent of motor apparatus, which position he held until his recent promotion. Mr. Webster started as an apprentice with the company in 1894, and has had a wide experience in railway motor design. In 1913 he was made director of building and equipment, and in 1919 became engineer of works.

Mr. Kaiser has had a wide experience with the company, starting as an office boy in 1895. Previous to his present promotion, he was assistant works manager of the East Pittsburg Works. Mr. Hoey entered the Westinghouse organization as a machinist apprentice in 1902. He worked in various departments until, in 1926, he was made superintendent of the manufacturing engineering department, which position he held until his present assignment.

C. NAAS, who has been connected with the Packard Motor Car Co. for about twenty years, has joined the Sterling Grinding Wheel Co., Tiffin, Ohio, and has been assigned to the Detroit district.

J. E. Webster



A. E. Kaiser

S. C. Hoey

HAROLD E. BOYD, formerly employment manager of the Republic Metalware Co., Buffalo, N. Y., has become industrial engineer with the Nashua Gummed & Coated Paper Co., of Nashua, N. H.

AUGUSTUS M. SOSA, who has been employed as a designing engineer with the American Tool Works Co. of Cincinnati, Ohio, for over fifteen years, has recently become associated with the Avey Drilling Machine Co., Cincinnati, Ohio, in a similar capacity.

HENRY HUSS has been appointed sales manager of the Putnam Division of the Shaw Crane-Putnam Machine Co., Inc., 100 E. 42nd St., New York City. A. P. AFANASSIEFF has been appointed assistant to the president of the company.

PROFESSOR ELIHU THOMSON, director of the Thomson Research Laboratory of the General Electric Co., has been named a member of the American Committee of the World Congress of Engineers to be held in Tokio, Japan, in November, 1929.

ED. S. CHAMBERLAIN has joined the Triplex Machine Tool Co., 50 Church St., New York City, in the capacity of machine tool salesman. Mr. Chamberlain was formerly connected with the National Tool Co. and the Kearney & Trecker Corporation in the New York territory.

FREDERICK B. HEITKAMP, who has been for several years advertising manager of the Cincinnati Milling Machine Co., Cincinnati, Ohio, has been made assistant sales manager. Mr. Heitkamp will continue to have charge of the company's advertising, in connection with the work of sales promotion.

M. W. MCARDLE was elected president of the Chicago Flexible Shaft Co., Roosevelt Road and Central Ave., Chicago, Ill., at the last meeting of the directors. Mr. McArdle has been actively identified with the company for twenty years, and formerly held the position of first vice-president and general manager.

A. M. MACFARLAND has joined the Lincoln Electric Co., Cleveland, Ohio, in the capacity of general sales and development engineer. Mr. MacFarland will devote his efforts to the development and special application of automatic carbon arc welding. He will be located at the main office of the company in Cleveland.

W. R. G. BAKER has been appointed managing engineer of the radio department of the General Electric Co., Schenectady, N. Y. Mr. Baker succeeds ADAM STEIN, JR., who has joined the executive staff of the Acoustics Products Co., a holding company, recently organized to take over a number of radio phonograph companies.

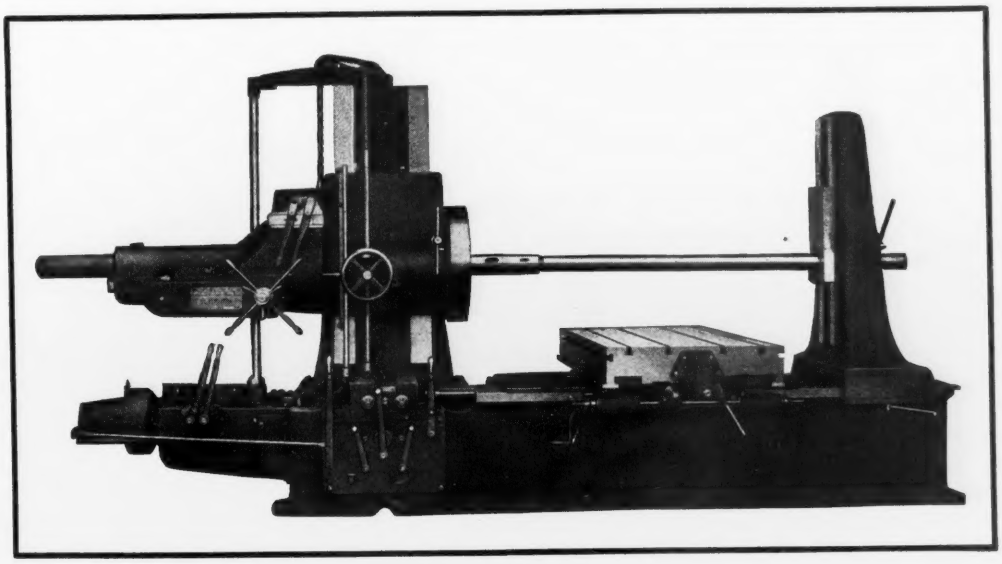
E. J. SHULER has joined the staff of engineers of the Fusion Welding Corporation, 103rd St. and Torrence Ave., Chicago, Ill. Mr. Shuler was, for eight years, in charge of welding for the New Orleans Public Service Corporation. In his new position, he will render engineering service to buyers of welding equipment and supplies.

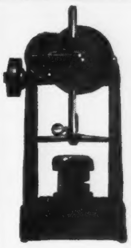
WILLIAM A. ROCKENFIELD, formerly general manager of the Baldwin Chain & Mfg. Co., Worcester, Mass., and identified with other manufacturing projects in a consulting capacity, is now associated with the High Speed Hammer Co., Inc., of Rochester, N. Y., in the capacity of vice-president, and will devote his time to engineering and sales.

T. M. MANLEY, who has served in various capacities for the Morse Chain Co., Ithaca, N. Y., for about twenty years, has recently been appointed manager of the district including the Mohawk Valley, northern New York, Vermont, western Massachusetts, and northeastern Pennsylvania. Mr. Manley's headquarters are at Ithaca, N. Y., at the main office of the company.

E. F. W. ALEXANDERSON, consulting engineer of the General Electric Co. and the Radio Corporation of America, was presented with the John Ericsson Medal at the fortieth anniversary banquet of the American Society of Swedish Engineers in New York on February 11. The award was given Dr. Alexanderson "for his outstanding contributions to the field of radio engineering."

D. F. MINER has recently been appointed manager of the material and process engineering department of the Westinghouse Electric & Mfg. Co., East Pittsburg, Pa. Mr. Miner





was first employed by the company in 1919 as an assistant to the section engineer of the electrical section. Since 1920, he has served in the capacity of section engineer of the experimental section of the material and process engineering department.

DONALD M. RYERSON, vice-president and general manager of Joseph T. Ryerson & Son, Inc., has been elected chairman of the board of directors, succeeding his father, Edward L. Ryerson, Sr., who died on January 19. EDWARD L. RYERSON, JR., vice-president in charge of plant operations and several sales divisions, succeeds his brother Donald Ryerson as vice-president and general manager. EVERETT D. GRAFF, who has been connected with the company for twenty-two years, has been elected vice-president in charge of purchases.

GENERAL JOHN J. CARTY, New York, has been awarded the John Fritz Gold Medal for 1928 for achievement in telephone engineering. This medal is awarded not oftener than once a year for notable scientific or industrial achievement by a board of sixteen representatives of the American Societies of Civil, Mining and Metallurgical, Mechanical, and Electrical Engineers, having an aggregate membership of 57,000, and is the highest recognition of merit made under the joint sponsorship of these national engineering societies.

E. R. NORRIS, formerly director of works equipment of the Westinghouse Electric & Mfg. Co., East Pittsburg, Pa., has been made general works manager of all manufacturing operations. Mr. Norris became connected with the company in 1892 as a general machinist at the Newark Works. Shortly afterward he was made foreman, and retained this position until 1894, when he was transferred to the East Pittsburg plant. In 1904, he served on the staff of the manager of works, in charge of rates, and later became assistant works manager.

J. B. GREEN, president of the Fusion Welding Corporation, 103rd St. and Torrence Ave., Chicago, Ill., made a lecture tour throughout the country during the month of February, lecturing at various welding conferences held under the auspices of several of the state universities and also at the annual meeting of the American Institute of Electrical Engineers in New York City. Mr. Green's lecture was based on advance research work done by the engineering department of the company with which he is associated. It covered a study of the flow of welding metal in both oxy-acetylene and metallic arc welding, and was illustrated by slow-motion moving pictures.

GUY HUBBARD has resigned as associate editor of *Mechanical Engineering* in order to become advertising manager of the National Acme Co., Cleveland, Ohio. He is now located at the executive offices of the company, E. 131st St. at Coit Road, Cleveland Ohio. Mr. Hubbard has been closely identified with the machine tool industry since 1915, and while a member of the headquarters staff of the American Society of Mechanical Engineers in New York City he was primarily concerned with matters relating to production machine tools and machine shop practice. He is a director of the Machine Tool Congress of the National Machine Tool Builders' Association.

CHARLES E. STONE, since 1924 vice-president of the Interstate Drop Forge Co., Milwaukee, Wis., manufacturer of drop-forgings, has been elected president, succeeding C. R. MESSINGER, who is a member of the board of directors and president of the Chain Belt Co. LAMAR S. PEREGOY was elected vice-president. C. C. BREMER and J. C. MERKER were re-elected treasurer and secretary, respectively. Mr. Stone was previously connected with the Chain Belt Co., first as purchasing agent and later as assistant to the president. The Interstate Drop Forge Co. is a member of a group of affiliated companies, including the Sivyer Steel Casting Co., the Federal Malleable Co., and the Chain Belt Co., all of Milwaukee.

* * *

TRADE NOTES

EQUIPMENT & SUPPLY CO., manufacturers' agent for mechanical equipment, machinery, construction materials and supplies, has opened an office at Louisville, Ky.

NATIONAL SUPPLY CO., Toledo, Ohio, is now representing the Liberty Machine Tool Co., of Hamilton, Ohio, in northwestern Ohio from the Toledo office of the company, and in the Indiana territory, from the Indianapolis office.

LEEDS, TOZZER & CO., INC., 75 West St., New York City, have been appointed special sales representatives for the Thew Shovel Co. of Lorain, Ohio, and the Universal Crane Co. of Elyria, Ohio, for the Eastern Railways of the United States.

WAGNER ELECTRIC CORPORATION, 6400 Plymouth Ave., St. Louis, Mo., has opened a sales office at 1006 Washington Ave., Houston, Tex. W. B. Arbuckle, who has been connected with the company for twelve years, has been placed in charge of the new office.

MOLTRUP STEEL PRODUCTS CO., Beaver Falls, Pa., has discontinued its connection with Henry Stewart & Co., Drexel Bldg., Philadelphia, Pa., and has opened a branch office at 617 Widener Bldg., Philadelphia, with Russell E. Crank in charge as district manager of sales.

WESTERN MACHINE TOOL WORKS, Holland, Mich., manufacturers of radial drilling machines, tapping machines, and shapers, have appointed O. L. Chapman representative of the company in the Detroit territory. Mr. Chapman has offices at 11245 Promenade Ave., Detroit, Mich.

JOSEPH H. DONBERG & CO. has been organized, with temporary offices at 1426 S. Harding Ave., Chicago, Ill., by Joseph H. Donberg, formerly with Louis E. Emerman & Co., machinery dealers of Chicago. The new company will deal in both new and used machine tools and equipment.

W. A. JONES FOUNDRY & MACHINE CO., 4409 W. Roosevelt Rd., Chicago, Ill., elected the following officers at the annual directors' meeting held in January: Vice-president, George W. Page; treasurer, William F. Coleman. Warren G. Jones will continue as president and general manager, and J. A Sizer as secretary.

WAGNER ELECTRIC CORPORATION, St. Louis, Mo., has opened a new branch sales office at 475 W. Peachtree St., N.E., Atlanta, Ga., to cover the states of Georgia, Alabama, and Florida. Roy F. Druschky, until recently a salesman in the St. Louis territory, and for sixteen years connected with the company, has been placed in charge of the new office.

BARBOUR STOCKWELL CO., 205 Broadway, Cambridge, Mass., has purchased the Broadway Iron Foundry Co. of the same city, one of the pioneer foundries of Boston. The Broadway Iron Foundry Co.'s plant will continue to be operated for the present by the Barbour Stockwell Co., with Robert C. Bird as manager. Eventually the business will be transferred to the Barbour Stockwell plant.

COVEL-HANCHETT CO. is the new name under which the MACHINERY CO. OF AMERICA is now operating. This change took place on January 1. As previously announced, the Wilmarth & Morman Co., Grand Rapids, Mich., has been consolidated with the Covel-Hanchett Co., Big Rapids, Mich., and the Wilmarth & Morman grinders are now being manufactured under the name of the Covel-Hanchett Co.—Wilmarth & Morman Division.

W. H. NICHOLSON & CO., 112 Oregon St., Wilkes-Barre, Pa., manufacturers of expanding mandrels, arbor presses, flexible and compression couplings, as well as steam specialties, have opened a new branch sales office at 1669 Montpelier St., Dormont, Pittsburg, Pa. Ralph A. Comstock, who was formerly connected with the home office, has been appointed district sales manager. The office will cover western Pennsylvania, eastern Ohio, and West Virginia.

TIMKEN ROLLER BEARING CO., Canton, Ohio, announces that an expenditure of $4,000,000 has been authorized to increase the production facilities of the company during the present year. The greater part of this expansion applies to the Canton plant, where both the steel mill and the bearing manufacturing plant will be considerably enlarged. The expansion has become necessary because of the increase in business which marked the past year and the expectations of a still greater increase in 1928.

HENRY PRENTISS & CO., 149 Broadway, New York City, dealers in machine tools, announce that they will discontinue their used tool business. Hereafter, the company will confine its efforts to the sale of new machines for the manufacturers whom it represents. The company has arranged to sell at an early date all its property in Jersey City, N. J., other than real estate, at public auction, under the management of Samuel T. Freeman & Co., Philadelphia, Pa.

FUSION WELDING CORPORATION, which operates as the Welding Equipment and Supply Division of the Chicago Steel & Wire Co., 103rd St. and Torrence Ave., Chicago, Ill., has

recently completed new engineering and research laboratories, which include a work-room supplied with various forms of alternating and direct current for welding, as well as oxy-acetylene cutting and welding equipment for weld testing and welding rod development. The company expects soon to have full working exhibits of welding equipment at its engineering laboratories, as well as at several cities throughout the country. These exhibits will be held at the company's offices in New York, Cleveland, Kansas City, Mo., and San Francisco.

A new company has been organized which has purchased the plant and business of the HANNIFIN MFG. CO., 621 S. Kolmar Ave., Chicago, Ill., manufacturer of air chucks, air-operated arbor presses, boring-bars, and other air-operated devices. The business will be continued under the same name. The president of the company is V. W. Peterson, and the vice-president and treasurer, C. B. Mitchell. Mr. Peterson and Mr. Mitchell also control and operate the Sherman-Manson Mfg. Co. of Chicago, manufacturer of tubular steel products. The Hannifin Mfg. Co. is making plans to build a two-story addition to its present plant, of about 25,000 square feet. It is also expanding its business by the installation of new plant equipment and by establishing representatives in the principal industrial centers of the country.

OBITUARIES

THOMAS ARTHUR JONES, vice-president of the W. A. Jones Foundry & Machine Co., Chicago, Ill., died at his home in River Forest, a suburb of Chicago, on January 19, aged sixty-four years. Mr. Jones was born on December 12, 1864, in Susquehanna County, Pa., and was educated in the public schools and the Wyoming Seminary. Going to Chicago at the time of the World's Fair in 1892, he became associated with the W. A. Jones Foundry & Machine Co., manufacturer of transmission machinery, afterward becoming the managing head. For many years he was secretary of the corporation and later served as president. At the time of his death he was vice-president. In 1918, he took over the active management of the Sackett Screen & Chute Co. of Chicago, in the capacity of president and general manager. He conducted this business up to the time of his death.

GEORGE BERGMAN, assistant secretary of the Cincinnati Milling Machine Co., Cincinnati, Ohio, and for twenty-six years affiliated with the company, died February 1, aged 44 years. In addition to having charge of the commercial department, Mr. Bergman was export manager.

COMING EVENTS

APRIL 3-5—Fifth annual convention of the American Oil Burner Association at the Hotel Stevens, Chicago, Ill. An exposition of oil burners will be held in connection with the convention. For further information, address the secretary of the association, 350 Madison Ave., New York City.

APRIL 19-21—Twelfth annual meeting of the American Gear Manufacturers' Association to be held at the Hotel Seneca, Rochester, N. Y. T. W. Owen, secretary, 3608 Euclid Ave., Cleveland, Ohio.

APRIL 25-26—Annual convention of the National Metal Trades Association at the Hotel Astor, New York City. Homer D. Sayre, commissioner, Peoples Gas Bldg., Chicago, Ill.

APRIL 25-27—Fifteenth National Foreign Trade Convention in Houston, Tex. O. K. Davis, secretary, National Foreign Trade Council, India House, Hanover Square, New York City.

APRIL 25-27—Annual meeting of the American Welding Society at the headquarters, 33 W. 39th St., New York City. M. M. Kelly, secretary.

MAY 14-17—Spring meeting of the American Society of Mechanical Engineers in Pittsburg, Pa. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

MAY 14-18—Twenty-first annual exhibit of machines, equipment, materials and supplies for foundries and the allied industries in the Commercial Museum, Philadelphia, Pa. In conjunction with the exhibit, the thirty-second annual convention of the American Foundrymen's Association will be held. C. E. Hoyt, manager of exhibits, 140 S. Dearborn St., Chicago, Ill.

JUNE 13-20—Annual meeting of the Mechanical Division V of the American Railway Association in Atlantic City, N. J.

JUNE 13-20—Annual convention and exhibition of the Railway Supply Manufacturers' Association in Atlantic City, N. J. Secretary-treasurer, J. D. Conway, 1841 Oliver Bldg., Pittsburg, Pa.

JUNE 25-29—Annual meeting of the Society for the Promotion of Engineering Education at the University of North Carolina, Chapel Hill, N. C. For further information, address Dean Braune, University of North Carolina.

JUNE 25-29—Annual meeting of the American Society for Testing Materials at Atlantic City, N. J.: headquarters, Chalfonte-Haddon Hall Hotel. Secretary, C. L. Warwick, 1315 Spruce St., Philadelphia, Pa.

JUNE 26-29—Semi-annual meeting of the Society of Automotive Engineers at the Chateau Frontenac, Quebec, Canada. Coker F. Clarkson, secretary, 29 W. 39th St., New York City.

SEPTEMBER 5-22—Fourth Machine Tool and Engineering Exhibition to be held at Olympia, London, England.

SEPTEMBER 12-14—Annual convention of the American Railway Tool Foreman's Association in Chicago, Ill.; headquarters, Hotel Sherman. Secretary and treasurer, F. A. Armstrong, 564 W. Monroe St., Chicago, Ill.

OCTOBER 8-12—Annual convention of the American Society for Steel Treating, to be held in conjunction with the tenth National Metal Exposition at Philadelphia, Pa. W. H. Eisenman, secretary, 4600 Prospect Ave., Cleveland.

CALENDARS RECEIVED

WESTFIELD GRINDING WHEEL CO., Westfield, Mass. Calendar for 1928, containing a colored reproduction of a painting of Lindbergh's airplane the *Spirit of St. Louis* crossing the Atlantic.

SOCIETIES, SCHOOLS AND COLLEGES

DREXEL INSTITUTE, 32nd and Chestnut Sts., Philadelphia, Pa. Catalogue for 1928-1929, containing calendar, outline of courses, and other pertinent data.

WORCESTER POLYTECHNIC INSTITUTE, Worcester, Mass. Annual catalogue for 1927-1928, containing calendar, courses of instruction, and other pertinent data.

SCHOOL OF MINES AND METALLURGY OF THE UNIVERSITY OF MISSOURI, Rolla, Mo. Catalogue for 1927-1928, containing calendar, outline of courses, and other data relating to the university.

NEW BOOKS AND PAMPHLETS

THE NATIONAL ELECTRICAL CODE—ITS PURPOSE AND DEVELOPMENT. 25 pages, 6 by 9 inches. Issued by the National Electrical Manufacturers' Association, 420 Lexington Ave., New York City.

SPEED AND POWER—THEIR RELATION IN LEATHER BELT DRIVES. By Roy C. Moore. Distributed by the Chas. A. Schieren Co., 30-38 Ferry St., New York City, as the fourth of a series on the "Seven Factors of Belting Economy."

MECHANICAL WORLD ELECTRICAL POCKET BOOK (1928). 338 pages, 4 by 6¼ inches. Published by Emmott & Co., Ltd., 65 King St., Manchester, England. Price, 1/6; by post, 1/9.

This is the twenty-first edition of this well-known little electrical pocket book. Several additions have been incorporated in the new edition, including sections on electrical calculations, estimating for wire-men, electricity in textile mills, etc. A number of new tables have also been included, among which may be mentioned those on power consumption of electrical appliances, current taken by electrical motors; lead accumulators; and insulated copper conductors.

PROCEEDINGS OF THE THIRTIETH ANNUAL MEETING OF THE AMERICAN SOCIETY FOR TESTING MATERIALS AT FRENCH LICK, IND. Published in two parts; Part I, 1142 pages, 6 by 9 inches; Part II, 564 pages, 6 by 9 inches. Published by the American Society for Testing Materials, 1315 Spruce St., Philadelphia, Pa. Price for each part, $6, bound in paper; $6.50, in cloth; and $8, in half leather binding.

Part I of the proceedings contains committee reports and new and revised tentative standards. Part II contains thirty-three technical papers presented before the meeting, with discussion.

SHIP MODEL MAKING. By Captain E. A. McCann. 205 pages, 6 by 9 inches. Published by the Norman W. Henley Publishing Co., 2 W. 45th St., New York City. Price, $2.50 net.

This is the third volume of a series of ship model making books, the present volume being devoted to instructions for making a model of the U.S. Frigate *Constitution*. The book describes everything required for making a ship model of this type, from tools and materials to the finishing touches. The instructions are given in such a way that they can be easily followed by an amateur, and yet they are complete enough to enable the expert to build an exact scale model.

PROFITABLE APPLICATION OF ELECTRIC INDUSTRIAL TRUCKS AND TRACTORS IN INDUSTRY. 89 pages 8½ by 11 inches. Published by the Society for Electrical Development, Inc., 420 Lexington Ave., New York City. Price, $1

This little handbook on the uses of electric trucks in American industry has been compiled through the cooperation of twenty manufacturers of electrical industrial trucks and tractors and storage batteries and accessories, who are engaged in a cooperative market development program. The material is based on a survey of 200 typical plan operations covering sixteen major industries, made by H. J. Payne of the survey committee of the American Society of Mechanical Engineers. For each of the industries, the operating processes and the particular type of truck suited to individual jobs are described. An outline of operating costs, together with a tabulation of direct savings effected by the use of this equipment, is given.

SPUR GEARS. By Earle Buckingham. 451 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 370 Seventh Ave., New York City. Price, $5.

The purpose of this book, as stated in the preface, is to bring out as clearly and simply

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PIERCING—

Saves Stock and Machining on This Forging

THIS Universal Joint Housing is forged exactly as shown at the left from 2-$\frac{1}{8}$-inch stock in three operations of a 4" *AJAX Heavy Duty Upsetting Forging Machine.* All operations are of course performed at one heat.

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The *saving in stock* by this piercing method, although considerable, is small compared with the *saving in labor* over machining the hole from the solid.

The excellent alignment of AJAX Forging Machines with long continuous-bearing, top-suspended, header slide and almost equally long extended die slide, with all bearings above the line of scale and water, makes possible the production of numerous forgings of this character at tremendous savings.

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as possible the fundamental characteristics of spur gears. The attempt has been made to give a complete mathematical exposition of the subject as simply as possible, and at the same time to include in the text sufficient explanation so that the reader may grasp the subject without following through all the mathematical proofs. With this end in view, many tables have been included to simplify the use of the material. The text is divided into three sections, the first of which deals with the design of gear teeth; the second, with gear teeth in action, including a discussion of gear tooth loads, and the strength and durability of gear teeth; and the third, with the machining and measuring of gear teeth.

NEW CATALOGUES AND CIRCULARS

FLOOR PLATES. Carnegie Steel Co., Pittsburg, Pa. Circular containing data on Carnegie floor plates.

CRANES. Whiting Corporation, Harvey, Ill. Bulletin 179, containing instructions relating to the operation and maintenance of Whiting electric cranes.

CUTTER GRINDERS. Oesterlein Machine Co., Cincinnati, Ohio. Catalogue showing the Oesterlein new type of motor-driven Nos. 2 and 3 cutter grinders.

ELECTRIC MOTORS. Lincoln Electric Co., Cleveland, Ohio. Bulletin outlining the starting and operating characteristics of the Lincoln "Switch-Start" motor.

ELECTRICAL RESISTORS. Monitor Controller Co., Baltimore, Md. Bulletin 111, containing data on Monitor resistors, including ratings, weights, and dimensions.

WELDED PIPING. Linde Air Products Co., 30 E. 42nd St., New York City. Booklet descriptive of the application of welded piping in heating and plumbing systems.

NICKEL STEELS. International Nickel Co., Inc., 67 Wall St., New York City. Buyers' Guide, containing a list of manufacturers of nickel alloy steel products, classified according to product.

ELECTRIC FURNACES. Ajax Electrothermic Corporation, Trenton, N. J. Bulletin 4, descriptive of Ajax-Northrup electric high-frequency furnaces operating from static converters.

ELECTRIC FITTINGS. Crouse-Hinds Co., Syracuse, N. Y. Bulletin 2107, containing data on "Wedgtite" pipe hangers, flexible fixture hangers, and self-threading unions and connectors.

ARC WELDING EQUIPMENT. General Electric Co., Schenectady, N. Y. Circular GEA-823, descriptive of atomic hydrogen arc welding equipment for hand welding on 60-cycle circuits.

CLUTCHES. L. G. S. Mfg. Co., Indianapolis, Ind. Booklet illustrating and describing the L. G. S. spring clutch. Various installations are illustrated, and a wide range of applications suggested.

WIRE FORMING MACHINERY. Baird Machine Co., Bridgeport, Conn. Circular illustrating and describing Baird wire forming presses, and examples of work for which they are adapted.

MOTORS. Reliance Electric & Engineering Co., Ivanhoe Road, Cleveland, Ohio. Bulletin 202, illustrating and describing type T heavy-duty Reliance motors for direct current, equipped with ball and roller bearings.

PYROMETERS. Brown Instrument Co., Philadelphia, Pa. Booklet entitled "How the Other Fellow Does It," illustrating the use of Brown pyrometers in twenty different heat-treating jobs in the metal-working industries.

METAL SLITTING SAWS. Goddard & Goddard, 4726 Hastings St., Detroit, Mich. Circular containing information about "Go and Go" metal slitting saws, illustrating the different styles and giving data on a specific job.

NICKEL CAST IRON. International Nickel Co., Inc., 67 Wall St., New York City. Bulletin 205 in a series on nickel cast iron data and applications, treating of the practical and economic value of nickel and chromium in gray cast iron.

RECORDING INSTRUMENTS. Bristol Co., Waterbury, Conn. Catalogue 1502, describing Bristol recording wattmeters and recording frequency meters. A pamphlet containing list prices of wattmeters is distributed with the catalogue.

TRAMRAIL SYSTEMS. Cleveland Electric Tramrail Division of the Cleveland Crane & Engineering Co., Wickliffe, Ohio. Circular illustrating the use of Cleveland tramrail systems for moving products and materials in a variety of industries.

MILLING MACHINES. Kearney & Trecker Corporation, Milwaukee, Wis. Catalogue 31, descriptive of the features of the Mil-Waukee-Mil simplex and duplex production milling machines. Complete specifications of the two types are included.

BALL BEARINGS. New Departure Mfg. Co., Bristol, Conn. Sheets Nos. 179-FE and 184-FE for loose-leaf bulletin, illustrating, respectively, the application of ball bearings in a ten-spindle multiple drill head, and in centrifugal pumps for cutting compound.

PLANER AND JOINTER. C. E. Van De Veere & Son, 1405 Pacific-Southwest Bldg., Fresno, Cal. Circular illustrating and describing an electric combination planer and jointer for use in woodworking shops, cabinet making, manual training departments, etc.

PUNCH PRESSES. F. J. Littell Machine Co., 4125-27 Ravenswood Ave., Chicago, Ill., is issuing a new monthly publication entitled "Punch Press News," which will be devoted to news of interest to punch press manufacturers and concerns using punch presses.

GREASE LUBRICATING CUPS. Dot Lubrication Division, Carr Fastener Co., Cambridge, Mass. Circular illustrating and describing the new "Dot-O-Matic" pressure cups for industrial lubrication. The special features of construction are described and price lists are included.

LIFTING MAGNETS. Electric Controller & Mfg. Co., Cleveland, Ohio. Circular entitled "Handling Hot Ingots," showing how 19,000 pounds of hot ingots are lifted by the type SA EC & M lifting magnet. The details of construction of this magnet are illustrated and described.

DROP-HAMMERS. Erie Foundry Co., Erie, Pa. Bulletin 160, describing Erie board drop-hammers, and showing the various types of construction regularly furnished, including four-roll hammers and those with inserted-guide box-section frames. Installations of the various types are also shown.

INSULATING MATERIAL. Cutler-Hammer Mfg. Co., 1204 St. Paul Ave., Milwaukee, Wis. Pamphlet entitled "Come Adventuring," giving information on C-H cold-molded "Thermoplax," a new insulating material for such parts as bases for switches, radio dials, motor terminal blocks, etc.

DIE-CASTING MACHINES. Madison-Kipp Corporation, Madison, Wis. Bulletins DC-1 and DC-2, descriptive of the new Madison-Kipp die-casting machine. The operation and important features are described in detail, and a complete diagram of the machine, with the various parts numbered, is included.

GRINDING MACHINES. Norton Co., Worcester, Mass. Circular entitled "Norton Grinding Machines in Detroit," announcing the opening of a grinding machine demonstration room in the new Norton Building, at 5805 Lincoln Ave., Detroit, Mich., where Norton grinding machines are now on exhibition.

ELECTRICAL SUPPLIES. Westinghouse Electric & Mfg. Co., East Pittsburg, Pa. General catalogue (1928-1930) covering the line of electrical supplies made by this concern. This book contains 1171 pages, 8 by 11 inches, cloth-bound, and is provided with a complete subject index as well as a convenient thumb-index.

VALVES. Wellman-Seaver-Morgan Co., 7000 Central Ave., Cleveland, Ohio. Bulletin 89, containing specifications covering Wellman "Supertest" gate and globe valves, which are designed to meet exacting requirements in steam plants, oil refineries, pipe lines, hydraulic, air, gas, chemical service, and other industrial purposes.

GRINDING MACHINES. Covel-Hanchett Co., Wilmarth & Morman Division, Big Rapids, Mich. Circular illustrating and describing the line of grinding machines now being made by this company, including super-surface grinders, universal cutter and tool grinders, drill grinders, precision knife grinders, traveling-wheel face grinders, and automatic saw sharpeners.

SMALL TOOLS. L. S. Starrett Co., Athol, Mass. General catalogue 24, containing data on the complete line of tools made by this company, including steel rules, squares, protractors, test indicators, gages, micrometers, vises, V-blocks and clamps, center punches, hacksaws, etc. The book contains a list of the new tools which have recently been added to the Starrett line.

GEARS. Grant Gear Works, 2nd and B Sts., South Boston, Mass. Catalogue and price list No. 50 of stock gears, ready for immediate shipment, including spur, bevel and miter gears; worms; racks; and internal gears. Data is also given on sprockets; spiral and herringbone gears; bakelite pinions; worm-gear reducers and special reducers; and roller and silent chains.

MAGNETIC SEPARATOR PULLEYS. Cutler-Hammer Mfg. Co., 1204 St. Paul Ave., Milwaukee, Wis. Bulletin P-26, entitled "Magnetic Protection," giving complete information on magnetic separator pulleys for removing magnetic material from non-magnetic material. The pamphlet explains in detail the construction and design of the various types, and illustrates different installations.

ELECTRIC EQUIPMENT. General Electric Co., Schenectady, N. Y. Circular GEA-761A, containing data on improved brush-holders for railway motors. Bulletin GEA-910, treating of the proper method of removing and replacing pinions for type HM industrial haulage motors. Circular GEA-855, dealing with the application of electric drive to motor buses. Circular GEA-887, containing data on CR-3110 drum controllers.

PRECISION TESTING EQUIPMENT. Adam Hilger, Ltd., 24 Rochester Place, Camden Road, London, N. W. 1, England. Circular N-31, containing a reprint of an article from MACHINERY (London) entitled, "Testing Outfit for Precision Work," descriptive of the use of precision measuring equipment in manufacturing. Circular illustrating and describing the Hilger "Tenthou" comparator—an optical gage which measures to 0.0001 inch.

SILENT CHAIN DRIVES. Morse Chain Co., Ithaca, N. Y. Handbook on silent chain drives, containing complete instructions on how to design drives of this type for various requirements. A list of typical drives is given to assist engineers in estimating the cost of different types. In addition, tables are included, giving sprocket diameters, sprocket list prices, chain list prices, standard hub lengths, bores, and other data required in designing chain drives. Instructions are also given as to the installation, care, and operation of Morse drives.

VALVE TOOLS. K. O. Lee & Son Co., Aberdeen, S. D. Bulletin listing "Knock-Out" tools for reconditioning gas engine valve seats. These tools are made in two different types—the "Knock-Out" valve seat planer which refaces the old worn seats, narrowing them down to the proper size, and the "Knock-Out" valve reseater, which is used for cutting a recess in worn out or cracked valve seats for installing new ring seats. The bulletin contains a detailed description of the tools, as well as instructions for operating them. Complete specifications, including prices, are also given.